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We print this week the collection of shop kinks by D. P. Kellogg, master mechanic of the Southern Pacific Co., at Los Angeles, to which the first prize of $50 was awarded. A number of other valuable collections submitted in competition are also printed. The last issue in which these efficiency-producing devices was published was that of Oct. 1; the next collection will be published Dec. 3. The competition has been a success in every way, and has furnished ideas which ought to have a money value in every railway shop in the country.

We take great pleasure in renewing this profitable competition, and we offer a first prize of $50 and a second prize of $25 for the best collection of shop kinks submitted to the RAILROAD AGE GAZETTE on or before Dec. 13; the winning collection to appear in our issue of Jan. 7, 1910. Previous competitors may enter again, with a new collection of devices, if they choose to do so. As before, the award will be made on the basis of the best collection of three, four or five "kinks," but each competitor may send as many as he pleases, leaving the judges to make their own selections. Send the original tracings or photographs if possible; if the tracings are not available, send a blue print.

Since railway rates stood still while the cost of everything railways had to buy was increasing, from 1897 to 1907, what caused the great increase in railway profits? Shippers reply that it was due to the growth of traffic. Since shippers gave the increased traffic, the implication, of course, is that all the credit for the growth in net earnings belongs to them. A more impartial witness, perhaps, is W. M. Acworth, the English economist who said in an article in the *North American Review* for September: "But the main difference, I think, has arisen from the strenuous lesson of adversity taught to American railways in the year 1893, and from the way in which American railway officials took these lessons to heart. If an outsider might criticize, I should say that I am startled at the ingratitude which the American public has displayed in return for the marvelous skill and energy with which American railway men revolutionized the operation of American railways in the years when traffic began to recover after the panic of 1893." American railway managers have kept railway operating expenses from rising in proportion to the increases in the costs of labor and supplies by improving the railway plants and the methods of operating them. But while improvements in plants tend to reduce operating expenses they involve additions to permanent investment; and more net earnings are required to pay a return on the added investment. To argue, therefore, that since net earnings have increased, in spite of rises in the unit costs of labor and materials, there ought to be not increases, but reductions in rates, seems equivalent to arguing that the benefits of improved operation should not go to those whose good management and expenditures have made it possible, but to those who have furnished neither the brains nor the money to make it possible.

THE SUPPLY OF MACHINISTS AND APPRENTICES.

The rate of wages in any particular trade or branch of a trade is regulated to a large extent by the demand for and supply of workmen, and in prosperous times high wages in this country are the result of the scarcity of labor. In most European countries low wages are the result of a large surplus of workmen even in busy times.

In railway shops there is frequently a scarcity of workmen for car repairs, and this condition exists to-day at numerous points in the West, where ordinary carpenters and laborers can obtain better wages on outside work than is offered by railways for freight car repair men. The locomotive repair shops have not yet required full forces at most of the plants, and when that is the case it is likely that difficulty will be found in getting sufficient skilled machinists even at the high wages offered. The industrial development of the country has progressed more rapidly than the production of skilled workmen, and employers are now waking up to the fact that for a time at least new and unusual methods must be employed in the rapid training of boys and men for a class of work where large numbers of similar parts are produced by simple machine finish.

The automobile factories have absorbed such a large number of skilled machinists that the machine tool builders at the very opening of the busy season were confronted by the difficulty of getting enough machinists to carry on their works at full capacity. Large numbers of machinists are now employed about the power plants of hotels and large office buildings, electric light plants and street railways. These consumers of machinist labor are not also producers of it, and the burden of producing a larger proportion of machinists than has been customary heretofore is placed directly upon the manufacturers who are operating large machine shops.

The National Machine Tool Builders' Association at its recent meeting in New York considered the ways and means of meeting this condition, and several suggestive papers were read on the subject. These and the discussion showed that it was possible largely to increase the force available by creating a body of specialists on short-time apprenticeship instead of the all-round machinists by the longer four years' course. It is usually necessary to rearrange the work to some extent, so that a portion of it can be easily and simply machined by an ordinary workman after some experience and instruction. In some cases it is also necessary to arrange a portion of the shop and place the smaller, simpler machine tools, so that the apprentice school can be easily supervised. The young men are employed at fair wages, with the understanding that they are not to have a general course through the shop, but that they shall learn to operate certain machines, and by increasing skill and industry they are soon able to earn by piecework methods almost as much as a skilled machinist. When there is a supply of this class of workmen the all-round skilled machinist can be better employed with hand tools or in the erecting shop. The instructor should be a first-class machinist who has also natural talent for teaching and the patience and good nature necessary for that work.

In one year it is possible to make a specialist or helper for a certain range of work, and the plan can be extended to fairly intelligent men who are often found employed at ordinary labor, and who by a little special training become sufficiently skilful to finish up simple parts in about the same time as a regular machinist.

Manual training in industrial schools, high schools and reformatories is contributing in large measure to the production of a class of workmen who are of a somewhat higher grade than those just mentioned. While these are not regularly apprenticed machinists they have sufficient skill and a better education than many machinists, and should be able to turn out an equivalent amount of finished work of ordinary quality and thus prevent the shortage of machinist labor which seems to come with every prosperous period.

At the meeting of the American Federation of Labor in Washington the principal speaker favored the general introduction of manual training in public schools, and said that the industrial welfare of the nation would be advanced in this way. There is now a movement to largely extend manual training in the Chicago public schools.

At the New York meeting of Machine Tool Builders, Frederick A. Geier described the Cincinnati plan of industrial education, in which the university, the public school and the machine shop are co-operating. Here the Board of Education has established manual training in the elementary grades, and two large technological high schools have been built and equipped. At the University of Cincinnati a co-operative course in engineering has been given for three years. The boys who pass through high school can enter a six-year course, working one week at the shop and one week at the university. In this way about 200 young men are now employed in Cincinnati machine shops and at the same time getting a university education in engineering. The manufacturers find that by such methods a better class of young men is induced to learn the machinist trade, and those who might be indifferent to either study or manual training now find each kind of work alive with interest. In this way there is an ample supply of material for a proper proportion of machinist apprentices, who will become more efficient workmen than those trained by the old methods.

At the same convention of machine tool builders, M. A. Coolidge described the Fitchburg (Mass.) plan, which is an agreement between the school board and the manufacturers for a four years' course of apprenticeship. The first year is all school work; the other three years school and shop work, one week in school and one week in the shop. A certain degree of ability or fitness for the work is required, and those who do not come up to the mark are dropped, the aim being to produce high-grade mechanics.

It is thought that the ordinary manual training in high schools and in the technical colleges and universities has failed to produce skilled workmen, because the shop part is not put on an equality with the academic, and the work is not done under real commercial conditions, but the Cincinnati and the Fitchburg plans have overcome these objections.

The apprentice system on many of the large railways has been in recent years greatly improved, and the shop work is now supplemented by school instruction, which is paid for by the railways. At Altoona the Pennsylvania Railroad has provided a large tool equipment for the manual training shops in the high school, and an arrangement is made for a supply of educated apprentices for the shops.

All the methods mentioned above are being developed and improved by experience, and they are being extended to all the industrial centers of the country, so that the supply of apprentices and skilled workmen should soon equal the demand and excessive increase in the rate of wages be no longer necessary.

SHOP BELTING.

Belting is one of the most important items in shop operation and maintenance, yet its importance is not always realized by those who are responsible for economical working. There are two reasons for this: one, that the belting is divided into such small units that, like the small leaks of steam pipes, no one of them amounts to a great deal, and yet, when these leaks are piled up the one on top of the other, the aggregate is tremendous. The second reason lies in the fact that the purchase of belting is for the most part in the hands of men who do not know what they are buying. Consequently, reliance has to be placed almost entirely upon the reputation of the maker and his representations. When a belt is put on and no record is kept of where it is put or the work that it has to do, it is straightway forgotten, and when it breaks, no one but the belt-lacer knows how old it is or whether the break is due to well-earned old age or to poor material.

While there is no intention to exalt the functions of belting unduly, nevertheless they are of such a character that there are few things, especially little things, that can do more to lift the cost of operation than a multitude of inferior belts. Bad belts increase materially the time required for the performance of any particular job. They do this both by breaking and thus necessitating a shutting down of the machine while repairs are being made, and by continually slipping and stretching so that speed is decreased, and the cut so lightened that it is impossible to keep up to the full complement of a day's work. When a belt is loose and slips, the natural move on the part of the ordinary workman is to ease off on the amount of work he is doing until the slipping stops. This is almost invariably true where day work is being done. In the case of piecework, the man is a little more careful about the cutting down of the output, and so continues to crowd until a break occurs. Finally, there is the unsightliness of the stretched and crooked belt running its snaky course from pulley to pulley, and proclaiming its poor condition in every inch that it runs.

There has been so much written and printed in regard to belting and the materials that should be used in its production that there is no excuse for anyone being ignorant of the way to buy it. We all know that belting should be cut from the center of the hide, along the backbone, if it is of leather; that the cutting should not be carried too far forward upon the shoulder; that the hide of a steer is better than that of a cow or a bull, and, finally, that to cut from a point too near the belly is to insure a belt that will stretch out of all semblance to its original dimensions, and will be a source of constant annoyance and expense. It is, therefore, an easy mat-

ter to specify that the belt shall be made from these selected portions of the hide, and that it shall avoid the thin and soft portions. The trouble is, to see that the specifications are lived up to.

The same principle applies to the tanning. It is generally considered that the old, slow process of oak tanning is the one that must be used in case a first-class leather for belting is to be obtained. But there are so many short processes by which an inferior article can be produced that will look well and feel well to the uninitiated, that the way of the purchaser is full of pitfalls, and the chances of getting what is wanted are remote. For the man who is not a judge of leather, the only solution is to trust to the reputation of the maker. The question then becomes a matter of price. In a general way, price is apt to be an index of the standard of belting quality just as it is with other materials. If a rubber manufacturer is asked to quote on springs of a certain pattern, and, after giving his price, is told that the goods can be purchased elsewhere for half the price, he may or may not drop to the price offered. If he does both he and his customer know that this means simply an increase in the amount of adulteration, which varies inversely as the price. Similarly, in leather belting, a high price would ordinarily mean a better selection of leather and greater care in manufacture than the lower price would warrant. For large users it is, therefore, advisable to keep a somewhat close observation on the leather market, and to gage the quality of the belt by the margin existing between the price of the leather and that of the finished product.

It has been proposed that a system of standard specifications be adopted by the manufacturers of leather belting and that a stamp be adopted to be used by those who can make goods up to these specifications, so that anything bearing this mark would be practically guaranteed to be as good as it can be made. Any failure to live up to this standard would result in the withdrawal of the right to use the stamp, by action of the association. It is proposed that these standard specifications shall require that the belting be made from oak-tanned butts and cut only from the central portion of the hide; that no strips in excess of 4 ft. 6 in. long shall be used, and that every width of strip used shall be taken from some definite position in the hide. Then, as an additional check and protection to the buyer, a sample butt is to be issued, cut in accordance with the specifications. The value of this lies in the fact that for every position of the hide from which the leather is cut there is a peculiar kink given to the leather when it is bent. With this sample butt in hand it will then be possible for the user to take the belt to be examined and by bending it compare it with similar bends made in the loose strips of the sample butt and thus obtain an approximate idea of the place in the hide from which that particular piece of belting was cut. Such a system would at least make it possible to gain an approximate idea of the quality of belt that is being supplied in advance of its use.

These are practically the same specifications that have been adopted by the United States Navy, under which all of the belting used in that department of the public service is bought.

There is another point that is deserving of attention in this matter of the use of belts. While it is not probable that manufacturers will be ready, for a time, to guarantee a certain life to their belts, it is possible to get data by which the *probable* life can be obtained. That is the simple method of keeping a record of all belts bought and applied. This record should include the name of the manufacturer, the type of belt, the price paid, the size, the number of ply, the length, the date when taken up and the amount cut out at each taking up, the machine to which the belt was applied and the work that it was called upon to perform, and, finally, the date of its final removal and commitment to scrap. It would undoubtedly take some time to complete the record, but it would be of value during the whole period of the life of the belt, as indicating its specific performance, and so would act as a check not only on itself, but on all other belts in similar work. Then, if a belt surpassed it in appearance at any stage or was wearing away more rapidly and showing signs of stretching and snakiness, the relative values of the two would be known at once. As it is, there are very few shops that have anything like a record of what they are doing with their belts or the work that they are getting out of them; hence it is impossible to hold the manufacturer to anything like a guarantee. A belt is bought on the statement that it is of oak-tanned leather, cut from the center of the hide. The price is satisfactory; in fact, the buyer congratulates himself on having secured a bargain and resolves to patronize that maker in the future. Then he puts the belt to work and straightway forgets all about it. Another belting requisition comes in and is passed, and the process is repeated to the end of time, with the poor quality belt coming in again and again. It is just this sort of ignorance and indifference that the maker counts on when he talks center of back and sells belly!

EFFICIENCY AND STANDARD COSTS.

Harrington Emerson, who is a specialist in organizing railway mechanical departments so as to get the utmost service out of every dollar expended, has written a rather remarkable book dealing with the general broad problem of efficiency, with particular reference to shop operations.*

Mr. Emerson begins with the interesting comment that nature's operations are characterized by marvelous efficiency and by lavish prodigality, and that man is a child of nature as to prodigality, but not as to efficiency. If it had happened the other way—if he had followed nature's lead as to efficiency, but had taken up parsimony as a distinctly human virtue—the human race would have been wealthy beyond conception. Mr. Emerson believes that most political economists have erred in preaching parsimony rather than efficiency, and he thinks it is better to aim at efficiency first, thereby working along the lines indicated by nature.

We do not vouch for the accuracy of all Mr. Emerson's calculations as applied to his graphic illustrations of the principles he teaches, but we present them as he gives them. He points out that a firefly converts the hydro-carbon of its food into light with an efficiency of 40 per cent., whereas man wastes three-fourths of the coal in the ground, brings the remaining quarter to the surface by inefficient labor and appliances, and doubles, triples and quadruples its cost by transportation charges to the furnace door. Rarely is as much as 10 per cent. of the energy of the coal transformed into electrical energy, and of this 10 per cent. only 5 per cent. can appear as light. Ten to twenty times as much light is provided as necessary on the writing table, because of the distance of the bulb from the place where the light is needed. Moreover, tne firefly does not use its light continuously, but only as it is needed. Thus, comparing the efficiencies on one hand with the wastes on the other, Mr. Emerson concludes that the firefly is 15,000 times as efficient as his human rival, the electrical engineer.

Mr. Emerson bases his study on the premise that the way to obtain efficiency is to perfect an organization, and, for descriptive purposes, he divides all organizations into two types—staff and line. The line supplies the many hands; the staff, the single head that directs them. In all organizations line and staff have their place, but long after the time when staff should have come to the rescue of line, line traditions and line prejudice have prevailed. In the navy a strong staff has of necessity been added to the line. Supreme as he was, no sea captain quite dared to claim that he knew all

**Efficiency as a Basis of Operation and Wages.* By Harrington Emerson. 171 pages; 5 x 7¼ in. Published by the *Engineering Magazine*, New York; 1909; cloth; 1909.

about furnaces and boilers, engines and propellers, so there have been developed in marine organization very strong staffs. But in the army there was not the same compulsion. It is von Moltke's greatest claim to fame that he perceived the deficiency of line organization in the army and supplemented it with a general staff which made the Prussian army the marvelously supreme organization that it became, shortly after 1860.

The theory of a general staff is that each topic that may be of use to an army shall be studied to perfection by a separate specialist, and that the combined wisdom of the specialists shall be supplied to the line by the staff. Thus, while each soldier in the line, the marching army, is trained to dig trenches, to take his place in a formation, and to shoot straight and reload, the staff must have one man who knows more about balloons than all the rest of the army put together; another who is a master of road making; another who is an expert on sanitation; another who knows all there is to be known about rapid-fire guns. Through the brains of the expert staff, the hands of the line can thus be made enormously more efficient.

Mr. Emerson finds that the organization of a railway, or, to be more specific, of a shop, does not differ in primary principle from the organization of an army. There must be a strong line organization; a multitude of willing hands, each trained to a certain degree of skill and each capable of carrying out expert instructions. There must also be a staff able to give these instructions fully and wisely.

The difficulty with most mechanical organizations is that the line organization, excellent as it is, is only partially supported by the staff, and, consequently, works at a low rate of efficiency. Mr. Emerson has carried out his theory in many railway shops, notably on the Santa Fe, by placing each of the main departments of installation and operation in the hands of the best expert to be found, and has been able to bring about enormous economies of operation. For example, the expense of maintaining shop machinery and tools on a certain railway in 1904 was $487,171; the unit cost in relation to output was $10.31. In the same year, on a competing and largely parallel railway working under similar conditions, the cost in the same year was $487,150, and the unit cost $9.55. As a result of staff activity and control on the first road, total cost had fallen to $315,844 in 1907, and the unit costs had fallen to $4.89; whereas on the other road, where line organization was not supplemented by staff organization, total costs had risen to $638,193, and unit costs had remained virtually constant at $9.81. This saving in expenses of $322,000 was brought about by a staff costing less than $10,000—and the $10,000 that it cost was included in the $315,844.

In brief, the work which Mr. Emerson expects the highly-trained staff to perform lies in standardizing the cost of overhead charges and of work done, in advance, the standards being based on most careful theoretical calculations. Then, with standard cost as a goal, the actual cost can be gaged closely. The objection to standardizing cost on the basis of actual performance is that the information is thereby delayed until little value is left in it, and, moreover, that it is fundamentally incorrect, since it mixes up with costs incidents that have no direct connection with them. Modern efficiency cost accounting considers separately three things: total expenses, which concern chiefly the comptroller; standard or efficiency costs, which concern alone the efficiency engineer; and current wastes, which concern both the comptroller and the efficiency engineer. It is designed to make a dollar work as hard as a skilled machinist does, and we are inclined to think that many readers of this book will wonder whether the dollars they are spending in mechanical plant and operation are doing the work of 100 cents, or of 75 cents, or only of 50 cents.

BALTIMORE & OHIO.

The development of the Baltimore & Ohio has been an exception to the general method of railway extension. Originally the line, which extended west and southwest about 70 miles from Baltimore, was intended to bring traffic to the port of Baltimore. As extensions were made further west, most of them were built to handle commodities already being produced in the new territory. This is just the opposite cause and effect relationship that determined railway building in most parts of North America. To-day the Baltimore & Ohio is a soft coal road, running from Philadelphia south to Baltimore, and from there west. At Cumberland, Md., the main line divides, one part running northwest to Chicago with a number of branches tapping Lake Erie, and the other part running west to St. Louis. Beside the soft coal traffic, which furnishes 44 per cent. of the total tonnage, the road carries a large tonnage of manufactures and a considerable tonnage of products of forests. In general freight business it competes with the Pennsylvania, the Big Four, of the New York Central Lines, and in soft coal business it competes with the Norfolk & Western, the Chesapeake & Ohio and the Pennsylvania.

Little attempt is made to compete with the Pennsylvania or the New York Central for passengers from New York; which the Baltimore & Ohio reaches over the Philadelphia & Reading—Central of New Jersey; to Chicago because the route offered by the Baltimore & Ohio is too roundabout. This, however, is probably not a great loss, since the Baltimore & Ohio is saved the very heavy expense of running such trains as the Twentieth Century Limited and the Pennsylvania Special.

As we have said, the Baltimore & Ohio's main line divides at Cumberland, and until recently there was no affiliated line connecting the main line that ran north to Chicago and the main line that ran south to St. Louis at their western end. During the past year the company secured an option on the controlling stock of the Cincinnati, Hamilton & Dayton. The C., H. & D. was taken out of the hands of the receiver and the Baltimore & Ohio has guaranteed principal and interest on $12,500,000 C., H. & D. first and refunding mortgage 4 per cent. 50-year bonds, and the principal and interest on $11,557,000 4 per cent. notes secured by the deposit of $13,000,000 C., H. & D. first and refunding bonds.

The C., H. & D. has a line running from Toledo south, crossing the northern main line of the B. & O. and extending on down to Cincinnati on the southern main line of the B. & O.

The advantage to the B. & O. of such a line as the Dayton road is that beside connecting the two western parts of the main line, the acquired lines run through a number of manufacturing cities in the Middle West and should therefore act as a distributor for the B. & O. coal and a collector for merchandise to be shipped east over the B. & O.

Dependent as it is so largely on conditions in the soft coal trade, the B. & O. was slower to feel the recovery in general business than, for instance, was such a road as the Southern Railway. Gross earnings in the fiscal year ended June 30, 1909, were $71,000,000. In 1908 gross earnings were $23,600,000. It must be remembered in comparing these two fiscal years that the one ended June 30, 1908, had six very good months before six very lean ones. The improvement in the coal business did not set in until June, 1909, so that while in general business there were six or seven lean months and six or five prosperous ones, in coal earnings, the Baltimore & Ohio had 11 poor months.

Earnings from freight traffic amounted to $53,900,000 in the 1909 year and $55,700,000 in the 1908 year. There were 9,270,000,000 tons of all commodities carried one mile in 1909. This is a decrease compared with 1908 of 517,000,000 ton-miles. Of the total ton-miles, the carriage of soft coal provided 4,068,000,000. This is 237,000,000 ton-miles less than in 1908. The average revenue per ton-mile of all freight was 0.581 cents in

1909 as compared with 0.569 in 1908. The average earnings per ton per mile on the soft coal is not as much lower than the rate on all commodities as might be expected. It was 0.411 cents in 1909.

The earnings from passenger traffic were $12,970,000 last year as against $13,700,000 the year before. The number of passengers carried one mile was 689,800,000 in 1909, a decrease of 36,800,000 in 1908. The average length of journey was 37.06 miles, which is less by 1.64 miles than in 1908. The average earnings per passenger per mile were 1.880 cents last year and 1,890 cents the year before.

Expenses last year both of maintenance and of cost of conducting transportation were materially decreased. The Baltimore & Ohio has been, for a number of years, a liberal spender from income for improvements and betterments. Since the receivership and reorganization in 1898 the road has been largely rebuilt. Grades have been reduced, second track has been added, and bridges in particular have been strengthened or replaced by permanent structures.

Last year total operating expenses amounted to $47,550,000. This is a reduction of $6,600,000 from expenses in 1908. Maintenance of way cost $9,000,000 last year and $10,600,000 the year before. Maintenance of equipment as a whole cost $11,000,000 last year and $12,700,000 the year before. Transportation expenses were $24,500,000 in 1909 and $27,700,000 in 1908. The reduction will be seen to be about equally divided between maintenance and conducting transportation.

The cutting down in transportation expenses was due largelv to increased operating efficiency. While it was not possible to reduce the scale of wages in either 1908 or 1909, it was possible to materially cut down the number of men employed and to make a much better selection of men. Materials also were somewhat cheaper in 1909 than in 1908, ties, in particular, being quite a good deal cheaper. The better results of operation are shown by an average train load of 425 tons as against 408 tons. The percentage of freight car mileage made by loaded cars was 63.85 per cent. in 1909 and 63.67 per cent. in 1908.

The following table shows the unit costs of maintenance:

	1909.	1908.
*Maintenance of way	$1,414	$1,663
†Repairs per locomotive	2,155	2,264
" " passenger car	621	785
" " freight car	54	64

*Per mile of first, second, etc., track, two miles of siding and switch tracks, being counted equal to one mile of main track.
†Does not include renewals, depreciation or superintendence charges.

While the sum spent per mile of track was less last year than the year before, there can be no question that the roadway and structures were fully maintained. The saving made last year was not made at the expense of future years. There is a plain distinction between making a present saving in maintenance, which simply defers charges that are bound to come eventually, and not making expenditures which, if they had been made, would have improved the property, but which will never *have* to be made.

The charge for repairs of locomotives is sufficient, apparently, as is also the charge for passenger cars. The sums are not, however, as large as the Pennsylvania spends. The charge per freight car seems rather low last year, even taking into consideration the fact that a great number of the Baltimore & Ohio cars are steel hopper and need comparatively little in the way of repairs. On June 30, 1908, the company had 1,809 locomotives, and at the end of the 1909 fiscal year there were 1,789 locomotives in service. On June 30, 1908, there were 1,073 passenger cars in service and 79,215 freight cars; in 1909 there were 1,065 passenger cars and 77,655 freight cars in service. The policy during the year was to scrap old equipment as soon as it became unserviceable, and new equipment was not ordered until the company foresaw, some little time ago, a fairly sure need of it. It is therefore a fair comparison in getting the average unit costs of repairs of equipment, as was done in the above table, to take as a divisor the number of pieces of equipment in service on June 30 in each of the respective years. Since the close of the fiscal year the company has given a number of orders for equipment, the most recent of these being for 110 locomotives and 10,000 freight cars. Like a good many other roads, just now, the Baltimore & Ohio is a little short of cars and probably also of motive power.

The principal changes on the balance sheet are: a decrease in the treasury bonds of the Baltimore & Ohio held, by the sale of $12,400,000 of these bonds, leaving $5,000,000 now in the treasury, and the decrease by payment of $11,700,000 loans and bills payable. The company had on June 30 current liabilities of $64,700,000, of which assets $14,800,000 was cash on hand. The balance sheet also shows that the cost of road has been increased by $5,600,000. Part of this sum was expenditures on capital account for improvements and betterments, but a great part of it is a matter of bookkeeping and represents the transfer of property formerly carried as real estate to the cost of road. Miscellaneous real estate was valued at $3,600,000 in 1909, a decrease from 1908 of $3,400,000.

The Washington Terminal station, the stock of which company the Baltimore & Ohio owns jointly with the Pennsylvania, has cost the Baltimore & Ohio in all $15,900,000, of which $600,000 was spent last year. The property is nearly completed, but there will be some additional expenditures necessary this year. The Chicago Terminal Transfer, whose property has been used under lease by the Baltimore & Ohio, and whose controlling stock has been held by the Chicago, Burlington & Quincy, went into the hands of a receiver in 1906, and the Baltimore & Ohio stood in danger of losing its only entrance into Chicago, the Burlington already having another station beside the Terminal Transfer. During the past year negotiations were made for the acquisition by the B. & O. of the controlling stock held by the Burlington, and it is understood that the arrangements have been about completed.

Since the close of the fiscal year business, and especially the shipment of soft coal and of manufactured articles from the territory served by the B. & O., has greatly improved, and it is estimated that the gross earnings of the Baltimore & Ohio and affiliated lines were greater in September than in any month in the company's history. As yet the B. & O. has not felt the competition of the Virginian or the Carolina, Clinchfield & Ohio in the soft coal business. Indications are that there will be a sufficiently greater demand for soft coal to take care of the output of the new lines in this field as well as of the old. The effect of new competition will be rather to lessen the share which the old roads, the B. & O., for instance, will get of new business. If the B. & O. can increase its westbound shipments of coal, which are comparatively* small now, through its connection with the Cincinnati, Hamilton & Dayton, it will be of great advantage by giving the Baltimore & Ohio a field in which to distribute its coal free from the competition of the other soft coalers.

The following table compares the results of 1908 and 1909:

	1909.	1908.
Average milege operated	4,004	3,992
Freight revenue	$53,872,416	$55,681,786
Passenger revenue	12,970,112	13,736,107
Total operating revenue	71,043,519	73,608,781
Maintenance of way	9,017,397	10,579,689
Maintenance of equipment	10,985,730	12,352,641
Traffic	1,608,452	1,669,029
Transportation	24,453,790	27,720,192
*Total operating expenses	23,491,542	19,457,902
Taxes	2,062,189	2,027,299
†Operating income	20,890,104	17,430,603
Gross corporate income	25,575,244	22,699,578
Net corporate income	13,020,965	10,435,344
Dividends	12,078,534	11,530,550
Additions and betterments	547,984	278,456
Surplus	394,447	1,373,662‡

*Neither expenses nor revenue of outside operations are included in this or the previous figures.
†After the deductions of the net deficit from outside operations.
‡Deficit.

*A considerable tonnage moves northwest to the lakes at certain times in the year.

THE RAILWAY'S PROBLEM IN CIVICS.

The period, measured roughly by the last three years, through which the American railway has passed and survived in good physical and fiscal health has had, as one of its leading features, a more intense relation of the railway to those activities and functions usually classed as civic. The railway as a carrier and the public as a governing body, acting through legislative and executive agents, have probably during the last three years had more contacts and collisions than in any previous ten years. The causes have come chiefly from the civic side. There have been anti-railway legislation in great volume and in many states, a decided increase of regulative commissions both in numbers and powers, and not a few decisions of the courts bearing upon the breach of civic authority on the one hand, and the rights of the railways on the other. The first of these causes, namely, railway legislation, will probably during the few years to come relax in its reaction from a previous time of energy. But the other two causes will be very strongly in operation. Civic administrators, represented chiefly by the public utilities commissions, must interpret new laws and in practice define their own increased powers. And as for the courts, they have before them an uncommon number of railway cases pending and many others sure to come. Even the Sherman law, long after its enactment, and after several interpretations by the higher courts, is still left in legal fog; and its amendment, changing it in vital parts, is not improbable at the coming session of Congress.

On the other hand, from the side of the railway, there have not been assertive forces equal to those on the civic side. The last three years have not been a time of brisk railway consolidation, though there have been two or three combinations of prime importance, and the last few months of Mr. Harriman's life promised others, and kept the general subject of railway coalition sharply before the public eye. But if the railway has not been aggressive, it has had to be actively defensive, and this alone has been enough to make its relation to public interests and policy closer and more acute. Moreover, there have been some special influences in the same direction and working from the railway side. There are, for example, the question of raising rates, so fiercely resisted by the shippers, in spite of the just and telling argument that, while cost of operation in every branch has increased, rates have remained stationary or gone lower. Terminal facilities in the great cities, compelled by their growth, is another point of public contact. Electrification is yet another, and from the closeness of the street railways to the problems of civic necessity and convenience there is reflected a new public relation on the steam line, especially if it happens to own street railways. Thus we see meeting from opposite quarters energies that are pushing and pulling the railway and the public closer together. The public supplies most of them; but the railway corporation has them also. Those energies will vary from time to time in kind, degree and objective points. But, as a whole, they will wax rather than wane.

Facing such a situation, present and future, the railway corporation, along with other useful corporations, fronts also a dilemma. There is a condition on the one hand, a moral ideal on the other. The condition is the imperfection—to use a very mild term—of those media that intervene between the railway interest and the community interest. The railway can fitly address to the electorate some such words as these: "We have for years been giving you better service. We have improved roadbed, increased speed, given you better stations, and we have *not* increased rates, but lowered them. What have you given us as a return and offset? Are your legislatures better in morale and intelligence? Is the 'strike' at the font of legislation, which all but compels the corporation to fight fire with fire, less common and more in disrepute? Are the commissions, now vested with larger powers than ever, much better in personnel than they were? Have not those increased powers, indeed, uncompanioned by any corresponding increase of integrity and intelligence, enlarged the power of mischief? And are not the political, personal and partisan motives still dominant, beginning at the packed primary and reaching up to state governors? You, the electorate, the spring of authority, do not even supply us with the good mechanism, let alone its operators. With what consistency, then, in a case where vast property interests are involved, do you demand a civic virtue in which you yourself default?"

The other and ideal side of the dilemma has also its line of reasoning. Theoretically and proverbially, the railway corporation, with its chartered fellows, is without soul. But it has a body and, at least, may have in a civic, if not theological sense, aspiration for a soul. In a good many ways, the railway corporation may be called a citizen and, in fact, a sublimated citizen. It pays taxes. It relies upon the police power for protection. It identifies itself with the progress, the welfare, moral and industrial, of the communities that it serves. It cannot itself vote at caucus or polls, but it can often command many votes. It has an interest in lawmaking and city ordinances—whether that interest is good or bad—far beyond the interest of the individual citizen, while its responsibilities are higher than those of that citizen. In the bedrock analysis and ideal state this corporative citizen and the ordinary citizen have, in most things, a community of interest analogous to that of capital and labor. That they have too often been thrown into opposition has been due primarily to the size of the railway interest, in which the many contacts with the public have necessarily included conflicts; and, secondarily, as stated, the at present almost radical faults of the agencies—law, administration and administrators—which lie between the railway corporation and the public—the faults for which the individual citizen is most to blame. In the long account of profit and loss due to those faults it is questionable whether the American railway has not lost more than it has gained. It has often obtained from legislatures and city councils great and undue privileges. It has also suffered mightily from the legislative "strike," from the forays of the lobby and even from the undue privilege itself—as when a railway is forced to take at a high price the watered stock of a competitor issued under legislative warrant.

In this period, which stretches far into the future, during which the area of demarcation between the public and the railway grows less and less and the relations of the two intensify the readjustments of those relations, will be a most important as well as interesting disclosure in our economic history. On the railway corporation rests the responsibility of acquiring, if not a soul the quality of higher citizenship. On the public rests the responsibility of lifting low citizenship to the higher plane that leads up to bettered civic mechanisms. The greater good for both will be in the achievement of the same object. As external forces press them together, will there be harmony and co-operation or new friction?

NEW BOOKS.

Heat Energy and Fuels. By Hanns v. Juptner. Translated by Oskar Nagel. New York: McGraw Publishing Co. 306 pages; 6 in. by 9 in.; 118 illustrations; cloth. Price, $3.00.

This book should properly be called the heat energy of fuels, for that is what it deals with almost exclusively. In the introduction there is a discussion of thermal and mechanical energy, and then the book proper opens with a long and very thorough discussion of the means of measuring temperatures. First the higher ones are considered, and the various forms of pyrometers are described and their methods of operation and the results that can be obtained from each demonstrated. In this, as all through the book, the mathematics of the case as well as the chemistry enters largely

into the treatment. There are seven chapters devoted to this part of the subject, and they cover pyrometry and its various methods, combustion heat and its determination, including the direct methods of this determination, incomplete combustion and the temperature of combustion. Beyond this the book treats of the various fuels that are used in the industries viewed from a chemical and mathematical point standpoint. The fuels so considered are wood, peat, lignite, bituminous and anthracite coal, artificial solid fuels, charcoal, peat coal, coke, briquettes, coking apparatus, and the various liquid and gaseous fuels. There are brief descriptions of the methods used in the production of several artificial fuels such as charcoal, briquettes and gas, so that even though the reader might not be familiar with these processes at the start, a good general idea would be obtained from the book. But it is chemical reaction and what must be done to insure that it shall take place in the best and most economical manner from a commercial standpoint that receives the major portion of the author's attention.

This is not a book to be placed in the hands of an ordinary workman with the expectation that he will derive any benefit from it; but to any man in charge of a large plant where it is the intention to use any sort of fuel in large quantities it will be of great value. This is especially true of the sections devoted to the manufacture of producer and water gas so that anyone who has to do with the making of either of these can hardly afford to be lacking in the information that it will give regarding the temperatures and pressures of air and the quality of steam that should be used. So, although the book is intended primarily for use in universities, it is of equal value to practising engineers, since it gives not only the fundamental principles but also the latest experimental data and practice.

Letters to the Editor.

COAL CAR DISTRIBUTION.

New York, Oct. 26, 1909.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

In my article on coal car distribution, published by you on Sept. 17, I spoke of the general agreement which obtains that in times of car shortage coal cars should be distributed on the basis of capacity of the mines, and that this would be more satisfactory if there were any general agreement as to what the capacity of a mine was. I called attention to the fact that the old and regular miner desired to have his capacity measured by what he had produced in the past, while the new and irregular miner claimed that his capacity should be measured by what he could produce in the future.

The same difficulty in distributing cars appears in other trades. The question as applied to the grain trade was discussed at the convention of the National Grain Dealers' Association, held recently in Indianapolis. The newspaper accounts of this meeting show that in the debate it was developed that attempts to distribute cars for grain equally often work a great injustice to the owners of small grain elevators in the country. The owner of one of these small elevators, it was represented, furnished a year-round market for the farming community and gave a continuous revenue to the railway. When he had a car of grain to load it could be very promptly put in the car from his elevator.

On the other hand, during harvest time, he comes into competition with the so-called "interloping grain merchant without investment or place to do business." This "interloper" comes into the field, gets the same number of cars as the regular dealer, takes his full 48 hours to load the car, and "as soon as the cream of the business is gone . . . disappears." It is reported that the grain dealers declared this to be unfair discrimination against the elevator in favor of the "scoop shovel" merchant, and that some insisted that the practice of furnishing cars to track dealers at points where elevators are in operation should be done away with; others felt that it would be better to continue the present even distribution of cars, but to reduce the free time to twelve hours and charge $5 a day demurrage.

Here we find a problem in distribution very similar to that which comes up in coal car distribution. The regular shipper who does his business all the year round, and probably with a low margin of profit, feels that he should be protected in his regular trade. On the other hand, the irregular trader who engages in business when profits are large feels that he has an equal right to cars.

On certain railways, in coal car distribution, a compromise is made by giving a rating which is partly based on the actual capacity to ship, and partly based on past performance. Some roads give these factors an equal weight, others make the past performance the more important. As intimated in my paper of September 17th, the Interstate Commerce Commission has given no formal disapproval to such plans, although they have been called to its attention.

To formulate a system of distributing cars for grain, based on capacity to ship grain, is a very difficult thing, as it is so hard to ascertain what the present capacity to ship is; but it would seem fair to consider past shipments in the distribution of cars for grain as well as in the distribution of cars for coal.

ARTHUR HALE.

SOUTHERN RAILWAY—LABOR EFFICIENCY.

Washington, D. C., Oct. 26, 1909.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

I have read your review of the annual report of this company, published in your issue of the 22d instant with much interest, and I wish to thank you for the intelligent and generally satisfactory way in which you have handled the subject.

I must take the liberty, however, of excepting to the second paragraph of your article—that dealing with labor conditions in the South. Whether it was so intended or not, I think the effect of that paragraph is to represent railway labor in the South as being notably inferior in efficiency to that in other parts of the country. I do not think this is warranted by anything we have said in our annual reports or by actual labor conditions. On the contrary, I believe that the average efficiency of our labor is as high as it is in other sections.

It is true that, during the period preceding the business depression of the fall of 1907, when the railways of the country were congested with business and thoroughly trained and competent men could not always be obtained, there was a lowering of average efficiency, but this condition was not peculiar to the South. It prevailed on the railways of the country generally. I am happy to be able to say that we are served by a body of employees in all departments who are not only as efficient as the men employed in similar capacities in other sections, but who are as a class intensely loyal to the company and its interests.

I take the liberty of calling this matter to your attention because the high standing of the *Railroad Age Gazette* gives special importance to anything appearing in its columns, and because I know that you would not willingly publish an inaccurate or misleading statement.

W. W. FINLEY,
President Southern Railway.

[The paragraph excepted to is as follows:

"Labor in the South, while cheap, is inefficient, especially in train operation, and particularly hard to impress with a respect for authority and the meaning of discipline. Southern trains were late because the labor that was available for train crews, despatching, etc., did not have a sense of time

value. This inefficiency was probably the first and one of the most difficult problems in the actual operation of the road."

Mr. Finley's correction of this statement is positive and authoritative and we accept it fully, but with some surprise. Lack of punctuality in train movement gives to an observer, perhaps unduly, an impression of inefficiency. It is usually, but not always, an indication of waste. Passenger train movement in railways in the southern states has been for years a common subject of good-natured merriment. But the record of trains on time is far from being an indicator of the utmost economy, efficiency, or prosperity. For example, in this respect, the Erie has made better showings than the Pennsylvania. The negro fireman used to be an inferior workman, but the writer has had recent opportunities to watch the negro's work on the foot plate, and that work has been quite good. At the price, it was surely economical. Too many train delays due to engine failures are chargeable to inefficiency, but track failures in excess of those on a costly road are excusable and justified on thin lines where the earnings cannot warrant making a high-priced road. Efficiency, therefore, should be understood to mean as good service as the men can give with such track and equipment as the amount of business justifies. It is indeed gratifying to hear Mr. Finley speak of his employees as "intensely loyal to the company and its interests." This we believe to be a result brought about by himself and his staff. It was not always so, and loyalty does not grow wild.—Editor.]

POWER FOR COMMISSION TO ADVANCE RATES.

Oklahoma City, October 22, 1909.

To the Editor of the Railroad Age Gazette:

I was much interested in the article in your issue of October 15 under the heading: "Should the Interstate Commerce Commission be Given Power to Advance Rates?"

In my judgment, by all means the commission should have the same power to advance rates as to reduce them, if the former at any time seems to be the proper way to adjust unequal or discriminatory conditions. I have no doubt that there are many interstate rates to-day which are too low, and that the only way that we can get rid of such disturbing conditions and the resulting odious comparisons is by having the commission empowered to raise such rates when necessary, so that all traffic may bear its just proportion of transportation charges. In coming legislation on the subject of transportation, this feature should not be overlooked.

J. H. Johnston,
Traffic Manager, Oklahoma Traffic Association.

LONGEVITY OF TOOLS AND RAILWAY EQUIPMENT IN ENGLAND.

Yeadon, Pa., October 15, 1909.

To the Editor of the Railroad Age Gazette:

Referring to your interesting reference in the *Railroad Age Gazette* of Oct. 8 to the long-continued use of tools, buildings and equipment on lines of English railways, may the practice not be due to other reasons than the well-known conservatism of the English people?

Adverse criticism has often been made in America of the large amount of material used in the construction of British machinery and equipment used on railways in that country in proportion to the amount used in American machines built for similar service. Is it not more than probable that this added material has so strengthened these machines as to not only render breakage less liable to occur, but also to permit the cutting away of working parts as the machines may have been overhauled from time to time to such an extent as would have rendered the American machines fit only for the scrap heap?

The builders of our machinery, when endeavoring to make sales of their goods, almost invariably lay stress on the durability of their machines and often state that "there is practically no wear out to them"; yet in the case of shop tools, at least, the machine has scarcely gotten well established in its new home before a representative of the maker comes along with some "new and improved" form of the device which will add an astonishing percentage to the work produced and greatly cut down the expense of operating—in fact, render the first machine fit for little else than retirement to the "has beens" of the junk yard.

So the procession moves along on this side, buying and almost as quickly selling again, with the shadowy form of the dealer in second-hand machinery ever near; and always hovering around the owners and managers like an uncanny ghost is the great question mark with its curved finger pointing downward in a sinister manner as it emphasizes the disturbing thought, does it pay?

A man was writing at a desk in a hotel when a friend said to him, "How can you write so well with such a miserable pen?" His reply was, "I run the pen and do not allow the pen to run me!" Now, it is often claimed that unless a man has first-class tools he cannot do first-class work; and while that is true to an extent, after all it is a question of the man running the tool and not allowing the tool to run him. Some of the most poorly finished pieces of work are often turned off from the highest type of tools because the attendant fails to attend to the tool but allows it to follow its own course "because they are automatic" or for some like reason. Many employers notice a growing tendency to superficiality and "slouchiness" in the work of a large number of the young men entering their service, not in the lines of business under consideration alone, but in many other lines. What are the underlying causes of this tendency is not the province of this article to consider, but unless some strong measures are speedily taken to eliminate them the thoroughness born of his conservatism will before many years place the English machinist and his machines far in advance of the man and the goods in the American shops—even if the former retains his old machines to do the work. C. H. Caruthers.

Contributed Papers.

LOCOMOTIVE TRACTIVE EFFORT TABLE.

[With an inset.]

The table shown herewith is one that has been calculated on the Southern Railway for the purpose of obtaining quickly the tractive effort of any locomotive. The formula for the simple locomotive is:

$$T = \frac{d^2 \times .85\,P \times S}{D},$$

in which

T = the tractive effort,
d = diameter of cylinder,
P = boiler pressure,
S = stroke of piston,
D = diameter of driving wheels,

In the table the figures are for

$$\frac{d^2 \times S}{D}$$

so that the tractive effort is obtained by multiplying by .85 P.

To obtain the factor, read out on the horizontal column corresponding to the diameter and stroke of the cylinder to the vertical column of the wheel diameter, and then multiply by .85 X the boiler pressure which is taken as the mean effective pressure. For any other point of cut-off than full gear, use mean effective pressure, from indicator card.

Cylinders dia. stroke.	Diameter of driving wheels. 26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.	51.
8 x 12..	29.5	28.4	27.4	26.5	25.6	24.8	24.0	23.3	22.6	21.8	21.3	20.8	20.2	19.7	19.2	18.7	18.3	....	....	....	....	....	....	....	....	....
8 x 14..	34.4	33.2	32.0	31.0	29.9	28.9	28.0	27.1	26.3	25.6	24.9	24.2	23.6	23.0	22.4	21.8	21.3	20.8	....	....	....	....	....	....	....	....
9 x 12..	37.4	36.0	34.7	33.5	32.4	31.4	30.4	29.5	28.6	27.8	27.0	26.3	25.6	24.9	24.3	23.7	23.1	22.6	22.1	....	....	....	....	....	....	....
9 x 14..	43.6	42.0	40.3	39.1	37.8	36.6	35.4	34.4	33.4	32.4	31.5	30.6	29.8	29.1	28.3	27.7	27.0	26.4	25.8	25.2	....	....	....	....	....	....
9 x 16..	49.8	48.0	46.3	44.7	43.2	41.8	40.5	39.3	38.1	37.0	36.0	35.0	34.1	33.2	32.4	31.6	30.9	30.1	29.4	28.8	28.2	....	....	....	....	....
10 x 14..	53.8	51.8	50.0	48.3	46.7	45.2	43.7	42.4	41.2	40.0	38.9	37.8	36.8	35.9	35.0	34.1	33.3	32.6	31.8	31.1	30.4	29.8	....	....	....	....
10 x 16..	61.5	59.2	57.1	55.2	53.3	51.6	50.0	48.5	47.1	45.7	44.4	43.2	42.1	41.0	40.0	39.0	38.1	37.2	36.4	35.6	34.8	34.0	33.3	....	....	....
10 x 18..	69.2	66.6	64.3	62.1	60.0	58.1	56.2	54.5	52.9	51.4	50.0	48.6	47.4	46.1	45.0	43.9	42.9	41.9	40.9	40.0	39.1	38.3	37.5	36.7	....	....
11 x 14..	65.1	62.7	60.5	58.4	56.5	54.6	52.9	51.3	49.8	48.4	47.0	45.8	44.6	43.4	42.3	41.3	40.3	39.4	38.5	37.6	36.8	36.0	35.3	34.6	33.9	....
11 x 16..	....	71.7	69.1	66.8	64.5	62.5	60.5	58.7	56.9	55.3	53.8	52.3	50.9	49.6	48.4	47.2	46.1	45.0	44.0	43.0	42.1	41.2	40.3	39.5	38.7	38.0
11 x 18..	....	....	77.8	75.1	72.6	70.3	68.1	66.0	64.1	62.2	60.5	58.9	57.3	55.8	54.4	53.1	51.9	50.6	49.5	48.4	47.3	46.3	45.4	44.4	43.6	42.7
12 x 16..	....	....	....	79.5	76.8	74.3	72.0	69.8	67.8	65.8	64.0	62.3	60.6	59.1	57.6	56.2	54.9	53.6	52.4	51.2	50.0	49.0	48.0	47.0	46.1	45.1
12 x 18..	....	....	....	....	86.4	83.6	81.0	78.5	76.2	74.0	72.0	70.0	68.2	66.5	64.8	63.2	61.7	60.3	58.9	57.6	56.3	55.1	54.0	52.9	51.8	50.8
12 x 20..	....	....	....	....	....	92.9	90.0	87.3	84.7	82.3	80.0	77.8	75.8	73.8	72.0	70.2	68.6	67.0	65.4	64.0	62.6	61.3	60.0	58.8	57.6	56.5
13 x 16..	....	....	....	....	....	....	84.5	81.9	79.5	77.2	75.1	73.1	71.2	69.3	67.6	66.0	64.4	62.9	61.4	60.1	58.8	57.5	56.3	55.2	54.1	53.0
13 x 18..	....	....	....	....	....	....	....	92.2	89.5	86.9	84.5	82.2	80.0	78.0	76.0	74.2	72.4	70.7	69.1	67.6	66.1	64.7	63.4	62.1	60.8	59.6
13 x 20..	....	....	....	....	....	....	....	....	99.4	96.6	93.9	91.4	88.9	86.7	84.5	82.4	80.5	78.6	76.8	75.1	73.5	71.9	70.4	69.0	67.6	66.3
14 x 18..	....	....	....	....	....	....	....	....	....	100.8	98.0	95.4	92.8	90.5	88.2	86.0	84.0	82.1	80.2	78.4	76.7	75.1	73.5	72.0	70.6	69.2
14 x 20..	....	....	....	....	....	....	....	....	....	....	108.9	105.9	103.2	100.5	98.0	95.6	93.3	91.2	89.1	87.1	85.2	83.4	81.7	80.0	78.4	76.9
14 x 22..	....	....	....	....	....	....	....	....	....	....	....	116.5	113.5	110.6	107.8	105.2	102.8	100.3	98.0	95.8	93.7	91.8	89.8	88.0	86.2	84.6
15 x 18..	....	....	....	....	....	....	....	....	....	....	....	....	106.6	103.9	101.2	98.8	96.4	94.2	92.0	90.0	88.0	86.2	84.4	82.6	81.0	79.4
15 x 20..	....	....	....	....	....	....	....	....	....	....	....	....	....	115.4	112.5	109.7	107.1	104.6	102.3	100.0	97.8	95.7	93.7	91.8	90.0	88.2
15 x 22..	....	....	....	....	....	....	....	....	....	....	....	....	....	....	123.7	120.7	117.9	115.1	112.5	110.0	107.6	105.3	103.1	101.0	99.0	97.1
16 x 18..	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	112.4	109.7	107.2	104.7	102.4	100.2	98.0	96.0	94.0	92.2	90.3
16 x 20..	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	121.9	119.1	116.4	113.8	111.3	108.9	106.7	104.5	102.4	100.4
16 x 22..	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	131.0	128.0	125.2	122.4	119.8	117.3	114.9	112.6	110.4
17 x 22..	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	144.5	141.3	138.2	135.3	132.5	129.8	127.2	124.7

Cylinders dia. stroke.	Diameter of driving wheels. 44.	45.	46.	47.	48.	49.	50.	51.	52.	53.	54.	55.	56.	57.	58.	59.	60.	61.	62.	63.	64.	65.	66.	67.	68.	69.	70.	71.
17 x 24..	157.6	154.0	150.8	147.6	144.5	141.5	138.7	136.0	133.4	130.9	128.4	126.1	123.9	121.7	119.6	117.6	115.6	113.7	111.9	110.1	108.4	106.7	105.1	103.5	102.0	100.5	99.1	97.7
17 x 26..	170.8	167.0	163.3	159.9	156.5	153.4	150.3	147.3	144.5	141.8	139.1	136.6	134.2	131.8	129.6	127.3	125.2	123.2	121.2	119.3	117.4	115.6	113.8	112.1	110.5	108.9	107.3	105.8
17 x 28..	183.9	179.8	175.9	172.1	168.6	165.1	161.8	158.7	155.6	152.7	149.8	147.1	144.5	141.9	139.5	137.1	134.9	132.6	130.5	128.4	126.4	124.5	122.6	120.8	119.4	117.3	115.6	114.0
18 x 24..	176.7	172.3	169.0	165.2	162.0	158.7	155.5	152.5	149.5	146.7	144.0	141.4	138.8	136.4	134.1	131.8	129.6	127.5	125.4	123.4	121.5	119.6	117.8	116.1	114.4	112.7	111.1	109.5
18 x 26..	191.4	187.2	183.1	179.2	175.5	171.9	168.5	165.2	162.0	158.9	156.0	153.2	150.4	147.8	145.2	142.8	140.4	138.1	135.9	133.7	131.6	129.6	127.6	125.7	123.9	122.1	120.3	118.6
18 x 28..	206.2	201.6	197.2	193.0	189.0	185.1	181.4	177.9	174.5	171.2	168.0	164.9	162.0	159.2	156.4	153.7	151.2	148.7	146.3	144.0	141.7	139.6	137.4	135.4	133.4	131.5	129.6	127.8
18 x 30..	220.9	216.0	211.3	206.8	202.5	198.4	194.4	190.6	186.9	183.4	180.0	176.7	173.6	170.5	167.6	164.7	162.0	159.3	156.8	154.3	151.9	149.3	147.3	145.1	142.9	140.9	138.8	136.9
19 x 24..	196.9	192.5	188.3	184.2	180.5	176.8	173.3	169.9	166.6	163.5	160.4	157.5	154.7	152.0	149.4	146.8	144.4	142.0	139.7	137.5	135.4	133.3	131.3	129.3	127.4	125.6	123.8	122.0
19 x 26..	213.3	208.6	204.0	199.7	195.5	191.6	187.7	184.0	180.5	177.1	173.8	170.7	167.6	164.7	161.8	159.1	156.4	153.9	151.4	149.0	146.7	144.4	142.2	140.1	138.0	136.0	134.1	132.2
19 x 28..	229.7	224.6	219.7	215.1	210.6	206.3	202.1	198.2	194.4	190.7	187.2	183.7	180.5	177.3	174.3	171.3	168.5	165.7	163.0	160.4	157.9	155.5	153.1	150.8	148.6	146.6	144.4	142.4
19 x 30..	246.1	240.7	235.4	230.4	225.6	221.0	216.6	212.3	208.3	204.3	200.6	196.9	193.4	190.0	186.7	183.5	180.5	177.5	174.7	171.9	169.2	166.6	164.1	161.6	159.3	156.9	154.7	152.5
19 x 32..	262.5	256.7	251.1	245.8	240.7	235.7	231.0	226.5	222.2	217.9	214.0	210.0	206.3	202.7	199.2	195.8	192.6	189.4	186.3	183.6	180.5	177.7	175.0	172.4	169.9	167.4	165.0	162.7
20 x 24..	....	....	....	....	200.0	195.9	192.0	188.2	184.6	181.1	177.8	174.5	171.4	168.4	165.5	162.7	160.0	157.4	154.8	152.4	150.0	147.7	145.4	143.3	141.2	139.1	137.1	135.2
20 x 26..	....	....	....	....	216.7	212.3	208.0	203.9	200.0	196.2	192.6	189.1	185.7	182.5	179.3	176.3	173.3	170.5	167.7	165.1	162.5	160.0	157.6	155.2	152.9	150.7	148.6	146.5
20 x 28..	....	....	....	....	....	....	....	....	215.4	211.3	207.4	203.6	200.0	196.5	193.1	189.8	186.7	183.6	180.6	177.8	175.0	172.3	169.7	167.2	164.7	162.3	160.0	157.8
20 x 30..	....	....	....	....	....	....	....	....	....	....	222.2	218.1	214.3	210.5	206.9	203.4	200.0	196.7	193.6	190.5	187.5	184.6	181.8	179.1	176.5	173.9	171.4	169.0
20 x 32..	....	....	....	....	....	....	....	....	....	....	....	....	224.5	220.7	216.9	213.3	209.8	206.4	203.2	200.0	196.9	193.9	191.0	188.2	185.3	182.9	180.3	
21 x 24..	....	....	....	....	....	....	211.7	207.5	203.5	199.7	196.0	192.4	189.0	185.7	182.5	179.4	176.4	173.5	170.7	168.0	165.4	162.8	160.4	158.0	155.6	153.4	151.2	149.1
21 x 26..	....	....	....	....	....	....	229.3	224.8	220.5	216.3	212.3	208.5	204.7	201.2	197.7	194.3	191.1	188.0	184.9	182.0	179.2	176.4	173.7	171.1	168.6	166.2	163.8	161.5
21 x 28..	....	....	....	....	....	....	....	237.5	233.0	228.7	224.5	220.5	216.6	212.9	209.3	205.8	202.4	199.2	196.0	192.9	190.0	187.1	184.3	181.6	179.0	176.4	173.9	
21 x 30..	....	....	....	....	....	....	....	....	....	....	245.0	240.5	236.3	232.1	228.1	224.2	220.5	216.9	213.4	210.0	206.7	203.5	200.4	197.5	194.6	191.7	189.0	186.3
21 x 32..	....	....	....	....	....	....	....	....	....	....	....	....	....	247.6	243.3	239.1	235.2	231.3	227.6	224.0	220.5	217.1	213.8	210.6	207.5	204.5	201.6	198.8
21 x 34..	....	....	....	....	....	....	....	....	....	....	....	....	....	263.0	258.5	254.1	249.9	245.8	241.8	238.0	234.2	230.7	227.2	223.8	220.5	217.3	214.2	211.1
22 x 26..	....	....	....	....	....	....	251.7	246.7	242.0	237.4	233.0	228.8	224.7	220.8	217.0	213.3	209.7	206.3	203.0	199.7	196.6	193.6	190.7	187.8	185.1	182.4	179.8	177.2
22 x 28..	....	....	....	....	....	....	....	....	260.6	255.7	250.9	246.4	242.0	237.7	233.6	229.7	225.9	222.2	218.6	215.1	211.7	208.5	205.3	202.3	199.3	196.4	193.6	190.9
22 x 30..	....	....	....	....	....	....	....	....	....	....	268.9	264.0	259.3	254.7	250.3	246.1	242.0	238.0	234.2	230.4	226.9	223.4	220.0	216.7	213.5	210.4	207.4	204.5
23 x 30..	....	....	....	....	....	....	....	....	....	....	293.9	288.5	283.4	278.4	273.6	268.9	264.5	260.2	256.0	251.9	248.0	244.1	240.4	236.8	233.4	230.0	226.7	223.5
23 x 32..	....	....	....	....	....	....	....	....	....	....	313.5	307.8	302.3	296.9	291.8	286.9	282.1	277.5	273.0	268.7	264.5	260.4	256.5	252.6	248.9	245.3	241.8	238.4
23 x 34..	....	....	....	....	....	....	....	....	....	....	333.1	327.0	321.2	315.5	310.1	304.8	299.8	294.8	290.1	285.5	281.0	276.7	272.5	268.4	264.5	260.7	256.9	253.2
24 x 30..	....	....	....	....	....	....	....	....	....	....	320.0	314.2	308.6	303.1	297.9	292.8	288.0	283.3	278.7	274.3	270.0	265.8	261.8	257.9	254.1	250.4	246.9	243.4
24 x 32..	....	....	....	....	....	....	....	....	....	....	341.3	335.1	329.1	323.4	317.8	312.4	307.2	302.2	297.3	292.6	288.0	283.6	279.3	275.1	271.1	267.1	263.3	259.6
24 x 34..	....	....	....	....	....	....	....	....	....	....	362.7	356.1	349.7	343.6	337.7	331.9	326.4	321.0	315.8	310.8	306.0	301.3	296.7	292.3	288.0	283.8	279.8	275.8
25 x 32..	....	....	....	....	....	....	....	....	....	....	370.4	363.6	357.1	350.9	344.8	338.9	333.3	327.9	322.6	317.4	312.5	307.7	303.0	298.5	294.1	289.8	285.7	281.6

Diameter of driving wheels.

0.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.
.6	24.8	24.0	23.3	22.6	21.8	21.3	20.8	20.2	19.7	19.2	18.7	18.3	....	....	....	....	....	....	....	....
.9	28.9	28.0	27.1	26.3	25.6	24.9	24.2	23.6	23.0	22.4	21.8	21.3	20.8	....	....	....	....	....	....	....
.4	31.4	30.4	29.5	28.6	27.8	27.0	26.3	25.6	24.9	24.3	23.7	23.1	22.6	22.1	....	....	....	....	....	....
.8	36.6	35.4	34.4	33.4	32.4	31.5	30.6	29.8	29.1	28.3	27.7	27.0	26.4	25.8	25.2	....	....	....	....	....
.2	41.8	40.5	39.3	38.1	37.0	36.0	35.0	34.1	33.2	32.4	31.6	30.9	30.1	29.4	28.8	28.2	....	....	....	....
.7	45.2	43.7	42.4	41.2	40.0	38.9	37.8	36.8	35.9	35.0	34.1	33.3	32.6	31.8	31.1	30.4	29.8	....	....	....
.3	51.6	50.0	48.5	47.1	45.7	44.4	43.2	42.1	41.0	40.0	39.0	38.1	37.2	36.4	35.6	34.8	34.0	33.3	....	....
.0	58.1	56.2	54.5	52.9	51.4	50.0	48.6	47.4	46.1	45.0	43.9	42.9	41.9	40.9	40.0	39.1	38.3	37.5	36.7	....
.5	54.6	52.9	51.3	49.8	48.4	47.0	45.8	44.6	43.4	42.3	41.3	40.3	39.4	38.5	37.6	36.8	36.0	35.3	34.6	33.9
.5	62.5	60.5	58.7	56.9	55.3	53.8	52.3	50.9	49.6	48.4	47.2	46.1	45.0	44.0	43.0	42.1	41.2	40.3	39.5	38.7
.6	70.3	68.1	66.0	64.1	62.2	60.5	58.9	57.3	55.8	54.4	53.1	51.9	50.6	49.5	48.4	47.3	46.3	45.4	44.4	43.6
.8	74.3	72.0	69.8	67.8	65.8	64.0	62.3	60.6	59.1	57.6	56.2	54.9	53.6	52.4	51.2	50.0	49.0	48.0	47.0	46.1
.4	83.6	81.0	78.5	76.2	74.0	72.0	70.0	68.2	66.5	64.8	63.2	61.7	60.3	58.9	57.6	56.3	55.1	54.0	52.9	51.8
..	92.9	90.0	87.3	84.7	82.3	80.0	77.8	75.8	73.8	72.0	70.2	68.6	67.0	65.4	64.0	62.6	61.3	60.0	58.8	57.6
..	....	84.5	81.9	79.5	77.2	75.1	73.1	71.2	69.3	67.6	66.0	64.4	62.9	61.4	60.1	58.8	57.5	56.3	55.2	54.1
..	....	....	92.2	89.5	86.9	84.5	82.2	80.0	78.0	76.0	74.2	72.4	70.7	69.1	67.6	66.1	64.7	63.4	62.1	60.8
..	....	....	....	99.4	96.6	93.9	91.4	88.9	86.7	84.5	82.4	80.5	78.6	76.8	75.1	73.5	71.9	70.4	69.0	67.6
..	....	....	....	....	100.8	98.0	95.4	92.8	90.5	88.2	86.0	84.0	82.1	80.2	78.4	76.7	75.1	73.5	72.0	70.6
..	....	....	....	....	....	108.9	105.9	103.2	100.5	98.0	95.6	93.3	91.2	89.1	87.1	85.2	83.4	81.7	80.0	78.4
..	....	....	....	....	....	....	116.5	113.5	110.6	107.8	105.2	102.8	100.3	98.0	95.8	93.7	91.8	89.8	88.0	86.2
..	....	....	....	....	....	....	....	106.6	103.9	101.2	98.8	96.4	94.2	92.0	90.0	88.0	86.2	84.4	82.6	81.0
..	....	....	....	....	....	....	....	....	115.4	112.5	109.7	107.1	104.6	102.3	100.0	97.8	95.7	93.7	91.8	90.0
..	....	....	....	....	....	....	....	....	....	123.7	120.7	117.9	115.1	112.5	110.0	107.6	105.3	103.1	101.0	99.0
..	....	....	....	....	....	....	....	....	....	....	112.4	109.7	107.2	104.7	102.4	100.2	98.0	96.0	94.0	92.2
..	....	....	....	....	....	....	....	....	....	....	....	121.9	119.1	116.4	113.8	111.3	108.9	106.7	104.5	102.4
..	....	....	....	....	....	....	....	....	....	....	....	....	131.0	128.0	125.2	122.4	119.8	117.3	114.9	112.6
..	....	....	....	....	....	....	....	....	....	....	....	....	....	144.5	141.3	138.2	135.3	132.5	129.8	127.2

Diameter of driving wheels.

50.	51.	52.	53.	54.	55.	56.	57.	58.	59.	60.	61.	62.	63.	64.	65.	66.	67.	68.	69.	70.
38.7	136.0	133.4	130.9	128.4	126.1	123.9	121.7	119.6	117.6	115.6	113.7	111.9	110.1	108.4	106.7	105.1	103.5	102.0	100.5	99.1
50.3	147.3	144.5	141.8	139.1	136.6	134.2	131.8	129.6	127.3	125.2	123.2	121.2	119.3	117.4	115.6	113.8	112.1	110.5	108.9	107.3
61.8	158.7	155.6	152.7	149.8	147.1	144.5	141.9	139.5	137.1	134.9	132.6	130.5	128.4	126.4	124.5	122.6	120.8	119.4	117.3	115.6
55.5	152.5	149.5	146.7	144.0	141.4	138.8	136.4	134.1	131.8	129.6	127.5	125.4	123.4	121.5	119.6	117.8	116.1	114.4	112.7	111.1
68.5	165.2	162.0	158.9	156.0	153.2	150.4	147.8	145.2	142.8	140.4	138.1	135.9	133.7	131.6	129.6	127.6	125.7	123.9	122.1	120.3
81.4	177.9	174.5	171.2	168.0	164.9	162.0	159.2	156.4	153.7	151.2	148.7	146.3	144.0	141.7	139.6	137.4	135.4	133.4	131.5	129.6
94.4	190.6	186.9	183.4	180.0	176.7	173.6	170.5	167.6	164.7	162.0	159.3	156.8	154.3	151.9	149.3	147.3	145.1	142.9	140.9	138.8
73.3	169.9	166.6	163.5	160.4	157.5	154.7	152.0	149.4	146.8	144.4	142.0	139.7	137.5	135.4	133.3	131.3	129.3	127.4	125.6	123.8
87.7	184.0	180.5	177.1	173.8	170.7	167.6	164.7	161.8	159.1	156.4	153.9	151.4	149.0	146.7	144.4	142.2	140.1	138.0	136.0	134.1
02.1	198.2	194.4	190.7	187.2	183.7	180.5	177.3	174.3	171.3	168.5	165.7	163.0	160.4	157.9	155.5	153.1	150.8	148.6	146.6	144.4
16.6	212.3	208.3	204.3	200.6	196.9	193.4	190.0	186.7	183.5	180.5	177.5	174.7	171.9	169.2	166.6	164.1	161.6	159.3	156.9	154.7
31.0	226.5	222.2	217.9	214.0	210.0	206.3	202.7	199.2	195.8	192.6	189.4	186.3	183.6	180.5	177.7	175.0	172.4	169.9	167.4	165.0
92.0	188.2	184.6	181.1	177.8	174.5	171.4	168.4	165.5	162.7	160.0	157.4	154.8	152.4	150.0	147.7	145.4	143.3	141.2	139.1	137.1
08.0	203.9	200.0	196.2	192.6	189.1	185.7	182.5	179.3	176.3	173.3	170.5	167.7	165.1	162.5	160.0	157.6	155.2	152.9	150.7	148.6
....	....	215.4	211.3	207.4	203.6	200.0	196.5	193.1	189.8	186.7	183.6	180.6	177.8	175.0	172.3	169.7	167.2	164.7	162.3	160.0
....	....	....	....	222.2	218.1	214.3	210.5	206.9	203.4	200.0	196.7	193.6	190.5	187.5	184.6	181.8	179.1	176.5	173.9	171.4
....	....	....	....	....	....	....	224.5	220.7	216.9	213.3	209.8	206.4	203.2	200.0	196.9	193.9	191.0	188.2	185.3	182.9
11.7	207.5	203.5	199.7	196.0	192.4	189.0	185.7	182.5	179.4	176.4	173.5	170.7	168.0	165.4	162.8	160.4	158.0	155.6	153.4	151.2
29.3	224.8	220.5	216.3	212.3	208.5	204.7	201.2	197.7	194.3	191.1	188.0	184.9	182.0	179.2	176.4	173.7	171.1	168.6	166.2	163.8
....	....	237.5	233.0	228.7	224.5	220.5	216.6	212.9	209.3	205.8	202.4	199.2	196.0	192.9	190.0	187.1	184.3	181.6	179.0	176.4
....	....	....	....	245.0	240.5	236.3	232.1	228.1	224.2	220.5	216.9	213.4	210.0	206.7	203.5	200.4	197.5	194.6	191.7	189.0
....	....	....	....	....	....	....	247.6	243.3	239.1	235.2	231.3	227.6	224.0	220.5	217.1	213.8	210.6	207.5	204.5	201.6
....	....	....	....	....	....	....	263.0	258.5	254.1	249.9	245.8	241.8	238.0	234.2	230.7	227.2	223.8	220.5	217.3	214.2
51.7	246.7	242.0	237.4	233.0	228.8	224.7	220.8	217.0	213.3	209.7	206.3	203.0	199.7	196.6	193.6	190.7	187.8	185.1	182.4	179.8
....	....	260.6	255.7	250.9	246.4	242.0	237.7	233.6	229.7	225.9	222.2	218.6	215.1	211.7	208.5	205.3	202.3	199.3	196.4	193.6
....	....	....	....	268.9	264.0	259.3	254.7	250.3	246.1	242.0	238.0	234.2	230.4	226.9	223.4	220.0	216.7	213.5	210.4	207.4
....	....	....	....	293.9	288.5	283.4	278.4	273.6	268.9	264.5	260.2	256.0	251.9	248.0	244.1	240.4	236.8	233.4	230.0	226.7
....	....	....	....	313.5	307.8	302.3	296.9	291.8	286.9	282.1	277.5	273.0	268.7	264.5	260.4	256.5	252.6	248.9	245.3	241.8
....	....	....	....	333.1	327.0	321.2	315.5	310.1	304.8	299.8	294.8	290.1	285.5	281.0	276.7	272.5	268.4	264.5	260.7	256.9
....	....	....	....	320.0	314.2	308.6	303.1	297.9	292.8	288.0	283.3	278.7	274.3	270.0	265.8	261.8	257.9	254.1	250.4	246.9
....	....	....	....	341.3	335.1	329.1	323.4	317.8	312.4	307.2	302.2	297.3	292.6	288.0	283.6	279.3	275.1	271.1	267.1	263.3
....	....	....	....	362.7	356.1	349.7	343.6	337.7	331.9	326.4	321.0	315.8	310.8	306.0	301.3	296.7	292.3	288.0	283.8	279.8
....	....	....	....	370.4	363.6	357.1	350.9	344.8	338.9	333.3	327.9	322.6	317.4	312.5	307.7	303.0	298.5	294.1	289.8	285.7

TRACTIVE POWER PER POUND OF MEAN EFFECTIVE PRESSUR

0.	51.	52.	53.	54.	55.	56.	57.	58.	59.	60.	61.	62.	63.
..	....	....	....	....	....	....	....	....	....	....	....	....	....
..	....	....	....	....	....	....	....	....	....	....	....	....	....
..	....	....	....	....	....	....	....	....	....	....	....	....	....
..	....	....	....	....	....	....	....	....	....	....	....	....	....
..	....	....	....	....	....	....	....	....	....	....	....	....	....
..	....	....	....	....	....	....	....	....	....	....	....	....	....
..	....	....	....	....	....	....	....	....	....	....	....	....	....
..	....	....	....	....	....	....	....	....	....	....	....	....	....
.9	....	....	....	....	....	....	....	....	....	....	....	....	....
.7	38.0	....	....	....	....	....	....	....	....	....	....	....	....
.6	42.7	41.9	....	....	....	....	....	....	....	....	....	....	....
.1	45.1	44.3	43.5	....	....	....	....	....	....	....	....	....	....
.8	50.8	49.8	48.9	48.0	....	....	....	....	....	....	....	....	....
.6	56.5	55.4	54.3	53.3	52.4	....	....	....	....	....	....	....	....
.1	53.0	52.0	51.0	50.1	49.2	48.3	....	....	....	....	....	....	....
.8	59.6	58.5	57.4	56.3	55.3	54.3	53.3	....	....	....	....	....	....
.6	66.3	65.0	63.8	62.6	61.4	60.3	59.3	58.3	....	....	....	....	....
.6	69.2	67.8	66.6	65.3	64.1	63.0	61.9	60.8	59.8	....	....	....	....
.4	76.9	75 4	74.0	72.6	71.3	70.0	68.8	67.6	66.4	65.3	....	....	....
.2	84.6	82.9	81.4	79.8	78.4	77.0	75.6	74.3	73.1	71.9	70.7	....	....
.0	79.4	77.9	76.4	75.0	73.6	72.3	71.0	69.8	68.6	67.5	66.4	65.3	....
.0	88.2	86.5	84.9	83.3	81.8	80.4	78.9	77.6	76.3	75.0	73.8	72.6	71.4
.0	97.1	95.2	93.4	91.7	90.0	88.4	86.8	85.3	83.9	82.5	81.1	79.8	78.6
.2	90.3	88.6	86.9	85.3	83.8	82.3	80.8	79.4	78.1	76.8	75.5	74.3	73.1
2.4	100.4	98.5	96.6	94.8	93.1	91.4	89.8	88.3	86.8	85.3	83.9	82.6	81.3
2.6	110.4	108.3	106.3	104.3	102.4	100.6	98.8	97.1	95.5	93.9	92.3	90.8	89.4
.2	124.7	122.3	120.0	117.7	115.6	113.5	111.5	109.6	107.8	106.0	104.2	102.5	100.9

70.	71.	72.	73.	74.	75.	76.	77.	78.	79.	80.	81.	82.	83.	84.
99.1	97.7	96.3	....	....	....	....	....	....	....	....	....	....	....	....
107.3	105.8	104.4	102.9	....	....	....	....	....	....	....	....	....	....	....
115.6	114.0	112.4	110.8	109.3	107.9	....	....	....	....	....	....	....	....	....
111.1	109.5	108.0	106.5	105.1	103.7	....	....	....	....	....	....	....	....	....
120.3	118.6	117.0	115.4	113.8	112.3	....	....	....	....	....	....	....	....	....
129.6	127.8	126.0	124.3	122.6	121.0	....	....	....	....	....	....	....	....	....
138.8	136.9	135.0	133.1	131.3	129.6	....	....	....	....	....	....	....	....	....
123.8	122.0	120.3	118.7	117.1	115.5	114.0	112.5	111.1	109.7	108.3	107.0	105.7	104.4	103.1
134.1	132.2	130.4	128.6	126.8	125.1	123.5	121.9	120.3	118.8	117.3	115.9	114.5	113.1	111.7
144.4	142.4	140.4	139.4	136.6	134.8	133.0	131.3	129.6	127.9	126.3	124.8	123.3	121.8	120.3
154.7	152.5	150.4	148.3	146.3	144.4	142.5	140.4	138.8	137.1	135.4	133.7	132.1	130.5	128.9
165.0	162.7	160.4	158.2	156.1	154.0	152.0	150.0	148.1	146.2	144.4	142.6	140.9	139.2	137.5
137.1	135.2	133.3	131.5	129.7	128.0	126.3	124.7	123.1	121.5	120.0	118.5	117.1	115.7	114.3
148.6	146.5	144.4	142.5	140.5	138.7	136.8	135.1	133.3	131.6	130.0	128.4	126.8	125.3	123.8
160.0	157.8	155.6	153.4	151.4	149.3	147.4	145.5	143.6	141.8	140.0	138.3	136.6	134.9	133.3
171.4	169.0	166.7	164.4	162.2	160.0	157.9	155.8	153.8	151.9	150.0	148.1	146.3	144.6	142.9
182.9	180.3	177.8	175.3	173.0	170.7	168.4	166.2	164.1	162.0	160.0	158.0	156.1	154.2	152.4
151.2	149.1	147.0	145.0	143.0	141.1	139.3	137.4	135.7	134.0	132.3	130.7	129.1	127.5	126.0
163.8	161.5	159.2	157.1	154.9	152.9	150.9	148.9	147.0	145.1	143.3	141.6	139.8	138.1	136.5
176.4	173.9	171.5	169.2	166.9	164.6	162.5	160.4	158.3	156.3	154.3	152.4	150.6	148.8	147.0
189.0	186.3	183.7	181.2	178.8	176.4	174.1	171.8	169.6	167.5	165.4	163.3	161.3	159.4	157.5
201.6	198.8	196.0	193.3	190.7	188.2	185.7	183.3	180.9	178.6	176.4	174.2	172.1	170.2	168.0
214.2	211.1	208.2	205.4	202.6	199.9	197.3	194.7	192.2	189.8	187.4	185.1	182.8	180.6	178.5
179.8	177.2	174.8	172.4	....	....	....	....	....	....	....	....	....	....	....
193.6	190.9	188.2	185.6	....	....	....	....	....	....	....	....	....	....	....
207.4	204.5	201.7	198.9	....	....	....	....	....	....	....	....	....	....	....
226.7	223.5	220.4	217.4	....	....	....	....	....	....	....	....	....	....	....
241.8	238.4	235.1	231.9	....	....	....	....	....	....	....	....	....	....	....
256.9	253.2	249.8	246.4	....	....	....	....	....	....	....	....	....	....	....
246.9	243.4	240.0	236.7	....	....	....	....	....	....	....	....	....	....	....
263.3	259.6	256.0	252.5	....	....	....	....	....	....	....	....	....	....	....
279.8	275.8	272.0	268.3	...	....	....	....	....	....	....	....	....	....	....
285.7	281.6	[illegible]	273.9	....	....	....	....	....	....	....	....	....	....	....

SSURE.

BEST ACCOUNTING METHOD FOR RAILWAY FUEL.*

Some railways have a special fuel department to purchase coal and distribute it to points along the line of the railway where it is needed for actual consumption. On many roads the purchasing agent or purchasing department takes care of this function. Such departments charge the different departments actually using the coal with what is delivered to them, the receiving department keeping the records and making reports of the consumption of the coal which is charged against them. There are other roads perhaps where the organization provides for the same department purchasing and distributing the coal, taking care of the record of receipts and disbursements and taking care of the accounts in connection therewith.

As it does not seem proper, for obvious reasons, to have all these transactions taken care of in one department, and as the system of accounts would be somewhat affected thereby, we will treat of an accounting system to cover an organization where the coal is purchased and distributed to points where it is needed for use by one department and where the department using is held responsible and accounts for what is received.

Many roads are able to obtain their company coal supply from mines on their own rails while other roads are so located that their coal supply has to be carried to and delivered to them the same as any other freight, but this would make no material difference in the method of starting a record of such coal when received.

After the matter of grade, prices, weights, inspection and points of delivery have been agreed upon between the railway company and the fuel company (details of which are, of course, handled by fuel agent or officer in charge of fuel purchases) the protection of the railway company's interests under the terms of such agreements is dependent upon the accountant to as great or perhaps greater extent than anyone else.

At the mine the coal is usually loaded into a small mine car. This is weighed before being transferred to the ordinary railway coal car. The combination of the weights as loaded from the mine car into the railway coal car, if the railway car is not passed over a track scale at the mine forms the basis of the way-billing weight of the carload of coal from the mines, but is not always the basis on which the mine company will charge the railway company, but forms the first basis for record on which accounting transactions may be based.

It is believed the practice is or should be for all railways to weigh on the company's scales all shipments of coal received in carload lots. The agent at such receiving point should make up a daily report showing the initials, number and weight of each car of coal received over the company's scale; this report to include also name of consignor, name of mine at which shipment originated, name of station to which billed and way-bill reference, such report to be forwarded daily to the head of the department whose duty it is to purchase and distribute the coal.

The agent at such receiving point reconsigns or way-bills the shipments to other points and should therefore show on his daily report the destination of each car of coal. For this way-billing it is thought essential to have a special form to be used for company fuel, these reports and records resulting therefrom forming the basis for the acceptance of the charges to be made by the mine companies for the coal.

Orders should be placed, of course, for the number of cars of coal or the number of tons of coal that it should be necessary to have at each point designated as a supply point. The agent at each station to which shipments are forwarded should be required to make out a daily report covering the cars of coal received, including car numbers, initials, weight and way-bill reference, the report to show also information as to cars disposed of, giving the initial, number and weight of each car, and whether delivered to fuel trestles, other departments, or shipped to other stations, such report to be forwarded daily to the department purchasing and distributing the coal.

Ledger accounts should be opened with each station or agent, which accounts should be debited with what has been reported and checked out as received, and credited with what has been reported as delivered to other departments, fuel trestles, or disposed of otherwise, the balance of such account would indicate the undisposed of coal as held by the agent and should be verified monthly or daily if desirable by inventory report from the agent.

REPORTS OF RECEIPTS FROM DEPARTMENTS CONSUMING.

When an agent or yardmaster or other representative whose duty it is to handle the movements of the cars, actually places them on the fuel trestle track or a track designated as receiving track, a form should be filled out by him showing the number and initial of the car or cars and the weight, on this form he should obtain the signature of the representative in charge of the coaling point as to the receipt of the coal as covered by the report.

This report should be made out in duplicate so that one form can be furnished to the department which purchases and distributes the coal, this form or receipt to be used as a basis, together with the agents' daily report as mentioned above, for the charge against the department which actually receives and uses the coal. The charge in total, if necessary, to be substantiated by the various forms or receipts from each station or coaling point.

The copy or duplicate of the form or receipt should be forwarded to the head of the department whose duty it is to take care of the technical or scientific part of the accounting, this report forming the basis for the record of the receipts of coal by the department using.

There would, no doubt, be differences from time to time on account of corrections in the weights of the cars as originally entered on the form or receipt mentioned when compared with the way-bill or the scale weight which may have been previously or subsequently reported by an agent or other representative to the head of the department purchasing and distributing the coal, or it may be that cars of coal after once being placed or reported placed are diverted to some other point. These differences, however, would all be investigated and the records straightened out when a debit is made by the fuel department against the department using the coal as the original receipts which will have been compared with the agent's daily report would be compared with and checked against the duplicate receipts certified to by the representative of the department using the fuel.

This method would arrive at the actual receipts of coal at any one particular point and result in the first actual basis for the accounts of the department consuming.

Under this system it would seem quite essential to run a ledger account with each individual coaling station similar to the accounts mentioned, to be kept with each agent, such ledger account to be debited with the receipts and verified at the close of the month as mentioned above.

REPORT OF DISBURSEMENT BY DEPARTMENTS CONSUMING.

Each individual coaling point should furnish daily a report showing the quantities of coal delivered from their receipts to each engine, the report to show the date, number of the engine, the class of service in which it is engaged and the number of tons loaded on the tender.

Similar report to be made if coal is delivered for other purposes. The report to show the exact purpose for which the coal is used and the number of tons. These reports to form the basis of credit to the ledger account previously mentioned being posted on the credit side of the account under proper headings so that at the close of the month the total under each heading can be drawn off and distributed to the proper operating expense account as prescribed by the Interstate Commerce Commission.

*From a committee report to the International Railway Fuel Association.

It will be readily seen that, with the ledger account mentioned, the difference between the debit and credit side as to number of tons would represent the number of tons of coal that should be on hand at the close of the month at each coaling point, providing, of course, that the reports of consumption were approximately correct, for, from the method mentioned the receipts at that point would be correct, giving the correct basis to start with.

thereto for the actual transactions taking place during the month.

ENGINES COALED DIRECT AT MINE TIPPLES.

We have not, in the foregoing, taken into consideration the method which should be followed in arriving at the necessary information where engines are coaled direct at the mines located on the line of the road. In such cases it is thought best to have an engineer's coal slip which should be made out

COAL RECEIPTS AND DISBURSEMENTS

Month ____ 190__ ____ Station ____ Division

RECEIPTS			DISBURSEMENTS (In Tons)										BALANCES (In Tons)		
Date	Pounds	Remarks	Date	Pass.	Pass. Sw.	Frght.	Frght. Sw.	Work						Dr.	Cr.
1			1										Balance 1st		
2			2										Receipts		
3			3												
4			4												
5			5												
6			6										Disbursements		
7			7												
8			8												
9			9												
10			10												
11			11												
12			12												
13			13												
14			14												
15			15												
16			16												
17			17												
18			18												
19			19												
20			20										Balance Close of Mo.		
21			21												
22			22										Balance Trestle Inventory		
23			23										Balance This Sheet		
24			24										Difference		
25			25										Difference to be Debited or Credited to Expenses as Follows		
26			26										To Pass.		
27			27										To Pass. Switch		
28			28										To Freight		
29			29										To Freight Switch		
30			30										To Work		
31			31												
Total Pounds			Total										Total		
			Adjustments												
Total Tons			Total												

INVENTORIES.

At the close of each month each coaling point should be required to send in an inventory of the coal that it has remaining over at the close of the month's bucsiness. If th ecoal left over is in cars, the number, initial and weight of car or cars should be given. If the coal remains over in pockets, the number of tons of coal in the pockets should be given. If the coal is on trestle platform, the number of tons on the platform should be given.

BALANCING LEDGER ACCOUNTS AND ADJUSTMENTS.

The total of this inventory would be used to verify the balance as shown by the ledger account and would be the means of verifying the accuracy or inaccuracy of the reports of the consumption or bring to light any error or inaccuracy that may possibly exist in the record of receipts.

These ledger accounts should be closed monthly on the basis of the inventories after a careful investigation of the differences existing, final adjustment being based on the consumption of coal actually reported. Adjustments, therefore, would not be allowed to accumulate but would be disposed of through accounts for the month in which the difference actually existed bringing in therefore to the operating expenses of the company or railway the actual amounts that should be charged in triplicate. The coal slip should show information as to date, the number of tons of coal taken, the engine number, class of service, and name of mine and where the mine is located.

Such slip should be signed by the engineer. The original should be left at the tipple, the duplicate to be forwarded by the engineer so that it will finally reach the department taking care of the accounts, and the triplicate to be retained by the engineer as his record and for reference in case of future investigation. The duplicate forms the basis of both receipts and disbursements and would be used, of course, in checking up the charges as made by the mine against the railway and as a basis for distributing to the railway company's operating expense account.

The engineer's slip, as far as the ledger accounts would be concerned, would be used the same as the receipts mentioned in connection with consignment of coal in cars and the daily report of the disbursements of coal from each coaling point.

ENGINEERS' COAL TICKET.

It is the practice on many roads, at present, to have the engineer give an order or sign a receipt for the number of tons of coal taken by his engine at each coaling point, as per the accompanying form.

Such order or receipt would, of course, aid considerably to verify the report of disbursements as made by the representative in charge of the coaling station, but the net results of the

Station..... Date..... .....

Engine No..... ..... Train No.....

Class of Service.....

Tons taken (Engineer's estimate).....

.....Engineer

.....Fireman

Tons taken (Fuel Foreman's estimate).....

... .Fuel Foreman

operation would be changed little, if any, by such additional receipt. If, however, a road has in effect or desires to put in effect an individual fuel performance record of report such order or receipt from the engineer would be almost necessary to avoid dispute when showing the individual outcome of operations.

The most difficult side of the transaction is to obtain reports of the actual disbursements, as this information is arrived at by most roads on practically an estimated basis, on either the figured capacity of a coal bucket or other conveyance. It is found, however, from experience and actual test that the men in charge of coaling trestles become quite efficient in arriving at approximate actual figures of the number of tons of coal placed on each engine. From the number of engines that are coaled each day and from the fact that any discrepancies which exist at the close of the month are reported to him, he is receiving a training daily which fits him to be reasonably accurate in his daily records and reports.

Some roads, it is believed, have experimented with various devices for getting at the actual weight of coal placed on an engine. Such experimenting, it is believed, has been expensive, and the results not permanent. It is a question, therefore, whether the expense involved in an endeavor to secure and use such a device would be in proportion to any better final results. It is thought, however, that the results which would be thus brought about could not vary from the results obtained from the system that has been outlined.

PRICES.

The prices of the coal which would be used to arrive at the valuation of the receipts and disbursements are usually made up from at least two sources. First, the mine price of the coal, and second, the transportation charges through to the point of receipt on the user's own line or to the point where the coal is actually consumed. If the mines are located on the user's own line, the price for company purposes should be based on the mine price only, as most roads are prohibited from considering a freight rate in connection with handling their own property. All the coal received by a road may therefore not be received at the same price. It is thought consistent, therefore, that the department purchasing coal and making disbursements to the other departments, arrive at an average price for all the coal received, so that an average price would be used for the disbursement of coal to operating expenses, which price will be the same regardless of the point at which the coal is actually used. In case coal received for locomotive use is delivered or sold to some other road or outside concern, it would be consistent, of course, to add to the mine price of the coal a freight rate, not only to cover the transportation charges to the point of delivery on the road, but also to include the road's own transportation charge. Such addition not to be used as a credit against the operating expenses of the road, but as a credit to the proper freight account. Any additional amount added to the cost of the coal would be taken into consideration, however, and used to reduce the average cost of the coal to the company for operation of the road.

It is not believed that the labor expended in handling the coal at each coaling trestle should be added to the cost of the coal, but that it should be taken care of separately and disbursed to the various expense accounts on the basis of the tons disbursed to each account. The average cost of handling per ton to be arrived at for each coaling point.

The main features of the system outlined have been in practical use with quite satisfactory results on one of the eastern roads which has a monthly receipt on an average of over 300,000 tons and a disbursement of about the same tonnage. During the year 1908 the average adjustment per month was a little less than 1 per cent. The main features have also been found to have been followed by one of the western roads with satisfactory results, although the transactions have been practically all taken care of under one special department.

LEAKAGE OF LOCOMOTIVE BOILER TUBES.

In a recent Bulletin of the International Railway Congress the subject of the leaks of locomotive boiler tubes was discussed, as follows:

The causes to which the administrations of different railways attribute leaks in the tubes are many and various, but they are of very unequal importance. In the first place, there are mechanical causes—bad execution of the work in setting in the tubes at the beginning, and bad maintenance; in particular, bad expanding and bad beading. It is evident that very careful work is to be recommended, but it must be remarked that the work, even if not well done, seldom results in producing leaks at the tube-plate of the smokebox. There is no reason why a different result should be obtained at the firebox tube-plate, were it not that other causes also contribute towards the production of leaks. Consequently, care in executing the work of setting in the tubes has, after all, only an influence of secondary importance.

Then we have the different physical causes: expansion and contraction phenomena, unequal variations of temperature, and incrustations.

As the tubes are at a higher temperature than the barrel they expand more, and consequently exercise a thrust on the tube-plates, which makes itself felt more particularly at the firebox tube-plate, as this is less firmly secured than the smokebox tube-plate. The expansion of the firebox tube-plate itself tends to deform it in its plane; the bottom of this plate is secured more firmly than its top, and consequently tends to become deformed along two diverging lines going towards the upper corners, and is subjected to compression in these directions; this is proved by the ovalization of the holes for the tubes, which show a larger diameter at right angles to these directions; this phenomenon has been observed on a number of copper tube-plates. The different effects of the ovalization of the holes, of the thrust of the tubes perpendicularly to the tube-plate, of the contraction of the tubes along their diameter, due to the fact that the temperature of the ends at the firebox tube-plate is somewhat higher than that of the body of the tubes which are surrounded with water, bring it about, after a certain time, that the limit of elasticity is exceeded and that the tubes are no longer as tight in the plate as when they had just been expanded and beaded over. In other words, the smoke tubes have, neither longitudinally nor transversely, the same expansion as the firebox tube-plate; it naturally follows that the joint must sooner or later work loose. That is prob-

ably what really happens in the majority of cases when leaks start. Evidence in favor of this explanation is given by the fact that leaks are very rare in the case of new tubes. These different effects are, moreover, much increased by any incrustations, which may materially increase the difference of temperature between the tube-plate and the water, a difference which normally amounts to only a few degrees.

Such phenomena, which are inherent to the materials actually used and to the quality of the water, cannot be overcome except by methodical renewals of half or all the tubes, effected by preference at regular intervals, which will be longer or shorter according to the quality of the water, or at least effected as soon as leaks result from the strains in the tubes. Experience shows that if leaks occur with new tubes tightening them once suffices, while if they appear in the case of fatigued tubes, where the limit of elasticity has been exceeded, fresh tightening may make it possible to run a few days longer, but in reality only aggravates the evil, and there is no really effective measure except to put in fresh tubes, and naturally at the same time the holes in the tube-plate must be made circular again.

Then, also, precautions have to be taken to reduce any phenomena resulting from the sudden contraction of the boiler. The firebox cools too quickly if the fire is drawn at the end of a journey; it would be desirable to let it go out slowly. Emptying the boilers when hot and washing them out with cold water also tend to produce sudden and unequal contractions. The proper amount of time should be devoted to these operations; the boilers should not be washed out with cold water until they have become completely cooled; washing should be done as far as possible with hot water; and even in this case, as hot water is seldom at a higher temperature than 122 or 140 deg. Fahr., the boiler should first be allowed to cool sufficiently.

While on a journey unequal variations of temperature due to bad management of the firing and of the supply of water may also, under certain conditions—that is to say, if the tubes are not in perfect condition—result in leaks. Moreover, if such bad management were the usual thing the tubes, even if perfect at the start, would very soon suffer.

E. Wells, assistant master mechanic, Wheeling & Lake Erie Railroad, in a very noteworthy paper before the American Railway Master Mechanics' Association in June, 1907, on the causes of leaks in boiler tubes, states that the principal cause of such leaks consists in the prolonged injection of cold water into the boiler while the regulator is closed, on down gradients, during stops, and at the end of the run; the comparatively cold water, 176 deg. Fahr., at most, sent in by the injectors at once goes to the bottom of the boiler, and if much enters and the fire is not brisk it materially cools the lower tubes; unequal variations of temperature result and leaks start at the lower tubes. It has, in fact, been observed for a long time that leaks nearly always start there. Mr. Wells has even observed that if one injector only is, as a rule, used, it is at the lower tubes on the injector side that leaks occur.

It must be observed, as regards the starting of the injectors when running down hill and during stops, that this is certainly the practice of most drivers; this is what is called utilizing the grades for taking water; however, leaks in the tubes do not always result.

Mr. Wells disputes the influence of successive heating and cooling on the play resulting between the tubes and the plates. (It must, however, be remembered that he is considering American fireboxes which are made entirely of steel.) In order to prove this he took a piece of tube having a diameter of 2¼ in and set it in a plate ½ in. thick; he then by means of a gas furnace heated it to 428 deg. Fahr. and then cooled it; these operations were repeated a number of times without any play resulting between the tube and the plate. But this experiment is not conclusive, because the piece of tube tried was not under the same conditions as the boiler tubes, which are held at the two ends and hence necessarily exercise thrusts on the tube-plates. As the second argument in favor of his contention, Mr. Wells mentions the fact, observed in practice, that leaks nearly always occur at the tubes of the lower rows, the upper rows remaining tight, although experiments made in which fusible metal was placed at different points on the tube-plate showed that neither the tube-plate nor the tubes were hotter in the lower parts than in the upper parts; consequently, something else than the heating and the cooling of a tube is necessary in order to produce play, and this other cause is the cooling of the individual lower tubes produced by the feed water.

It is certain that the lower tubes leak more frequently than the upper, and the influence of the feed water cannot be denied; but is this the only influence? Is it even the most important factor? This would seem to agree but badly with the other observation, also made in practice, that copper tube-plates often become bent inwards; and when this happens it is nearly always the lower portion which becomes so bent. This bending cannot be attributed to the arrival of the feed water, and just like the play between the tubes and the plate, which may be looked upon as its consequence, it is, rather, the result of the relative deformations of the plate and the tubes.

Mr. Wells also disputes the influence of the entrance of cold air, seeing that the temperature of the tube-plate, at least if there is but little incrustation, is only a few degrees higher than the temperature of the water, that an entrance of cold air cannot appreciably reduce the temperature of that tube-plate, and more especially cannot make it fall to below that of the water. These are perfectly definite facts, and the entrance of cold air, unless it is localized and very prolonged, can only have a secondary influence. It is, however, well recognized that brick arches, which protect the tube-plate against such entering air, exercise a beneficial influence on the condition of the tubes.

In order to prevent leakage at the tubes some companies, in addition to the precautions mentioned above as to the management, the maintenance and the washing of the boilers, have tried special arrangements.

The French Northern has tried expansion smoke tubes, the front ends of which pass through a stuffing-box fixed to the smokebox tube-plate. But the use of such stuffing-boxes, even if they allow the tubes to expand, do not remedy the loosening which results from the transverse expansion of the tube-plate of the firebox. This trial has not been extended. Then, also, in a number of its more recent locomotives, the French Northern has placed the end of the feed-water pipe in the steam.

The Midi is at present trying to prevent the leaks by sending the feed water into a tank placed above the level of the water and in the front of the boiler.

Several French railways, in order to reduce the giving of the interspaces and the ovalization of the tubes, which nearly always begin at the upper corners of the firebox tube-plate, reduce the diameters of the tubes placed there, so as to increase the magnitude of the interspaces.

The Italian State is at present trying the use of an injector of reduced size capable of supplying water continuously, the preliminary heating of the feed water and the installation of the Golsdorf water-softening apparatus, which consists of a flattened box, placed vertically between the barrel and the nest of tubes in which the feed-water pipe ends.

It may be remarked that it is not, as a rule, necessary to adopt injectors of reduced size in order to insure a continuous feed, for with the modern restarting injectors of the usual size the amount of water given may be varied from normal to practically double by adjusting the water valve. It would be eminently desirable to give the feed water a preliminary heating either by means of the exhaust gases or of the smokebox gases; various attempts in this direction have been made or are being made; unfortunately, the appliances required for the purpose are very complicated and no good solution of the question has as yet been obtained.

SCRANTON SHOPS OF THE DELAWARE, LACKAWANNA & WESTERN.

BY GEORGE L. FOWLER,
Associate Editor of the *Railroad Age Gazette.*

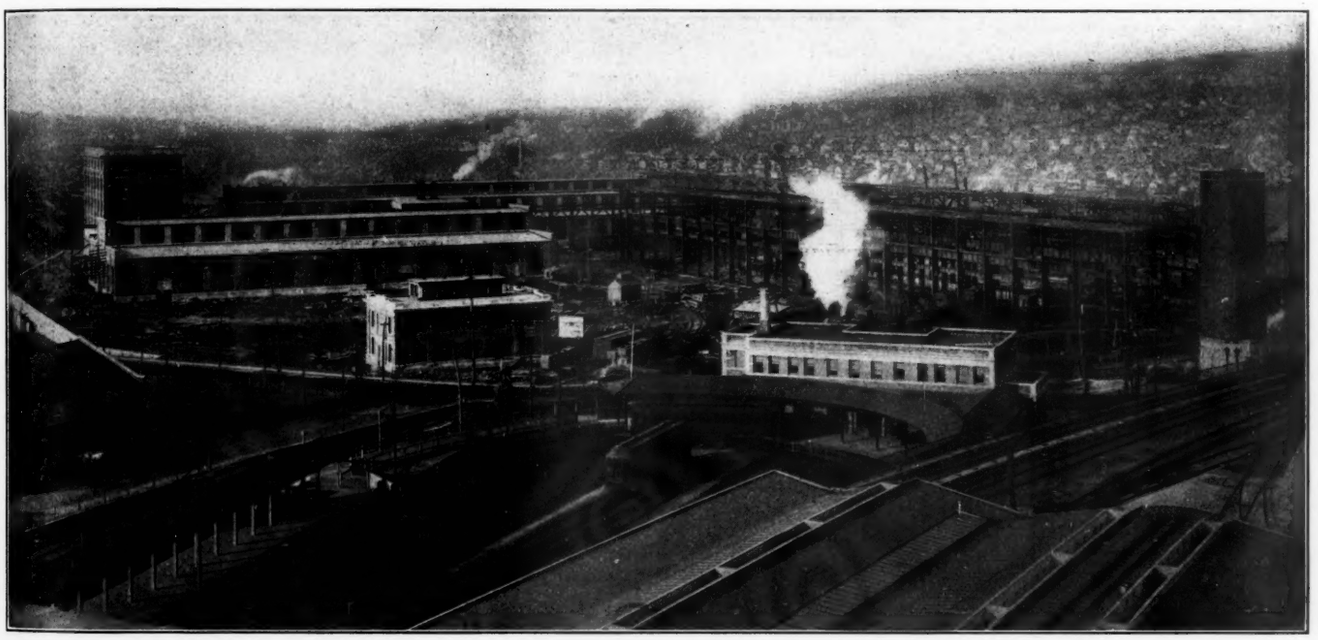
The Delaware, Lackawanna & Western has had large repair shops at Scranton, Pa., for many years, but the size of the locomotive equipment and the number of locomotives to be cared for have outgrown the capacity to such an extent that new shops have become a necessity and are, therefore, in course of erection.

They will be located east of the present shops and south of the tracks on the property formerly occupied by the Lackawanna Coal & Iron Co. The new buildings that are being erected are of steel frame structure and of solid reinforced concrete. As at present planned, there will be eight in all, including the main erecting and machine shop, the storehouse, gashouse, foundry, pattern shop, blacksmith shop, sand blast house and laboratory.

The principal building of all of these is the main erecting and machine shop. It is a steel frame and brick building, 582 ft. long and 342 ft. wide. As shown on the transverse section, it is divided into five bays. Those at the outside are used for erecting floors and for heavy machinery, and are each served by a 120-ton and a 20-ton traveling crane. The intermediate bays are for heavy machinery and are each to be served by a 15-ton traveling crane. The central bay will be for light machinery and will be served by four 1-ton traveling cranes. Along the east side of the building there will be an electric transfer table, by which each of the erecting pits can be served, but on the west side there is but one entrance and so it will be necessary to pick up a completed locomotive and carry it over its fellows to the entrance track. In order that this may be done on either side, the roofs of the outside bays are raised and are carried by lattice trusses and have a central monitor. The bottom chord of these roof trusses is 50 ft. above the floor. The girder for the 20-ton crane is supported by brackets riveted to and projecting from the columns, while that for the 120-ton crane is on the top and to one side of the column. This clear height above the floor is utilized at the south end of the east bay for the installation of the boiler shop tools. There is to be a shell riveter with a 14-ft. gap and above it with the rail 53 ft. from the floor, and running between the girders transversely to the shop, there is to be a traveling crane of 30 tons capacity. The hook of this crane will have a clear lift above the floor of 49 ft., or 35 ft. above the top of the gap of the riveter, so that there will be ample room to handle any boiler shell and firebox that is likely to be built. The width of the outside bays is 60 ft. between columns at the roof and 55 ft. at the floor. The span of the 120-ton crane is 56 ft. 6 in., and of the 20-ton crane 52 ft. 6 in. The width of the bay from center to center of the columns is 62 ft.

The intermediate bays are 60 ft. wide from center to center of columns, and the span of the traveling crane is 56 ft. The roof of this and the central bay is of the saw-tooth type with the glazed vertical sides facing the north. The height to the bottom of the trusses is 37 ft. 6 in. The southern slope of the roof is formed of a concrete slab 3 in. thick, over which there is a waterproofing consisting of a 3-ply tar paper, which is, in turn, protected by a coating of slag and tar roofing.

The central bay is double and has a width of 100 ft. between the centers of its outside columns, with the same heights as the intermediates. Here, because of the low capacity of the cranes, the girders for the runway are suspended from the roof and carry the rails on inside brackets. These cranes have a span of but 26 ft., or a little more than one-half the width of the bay.



General View; Scranton Shops.

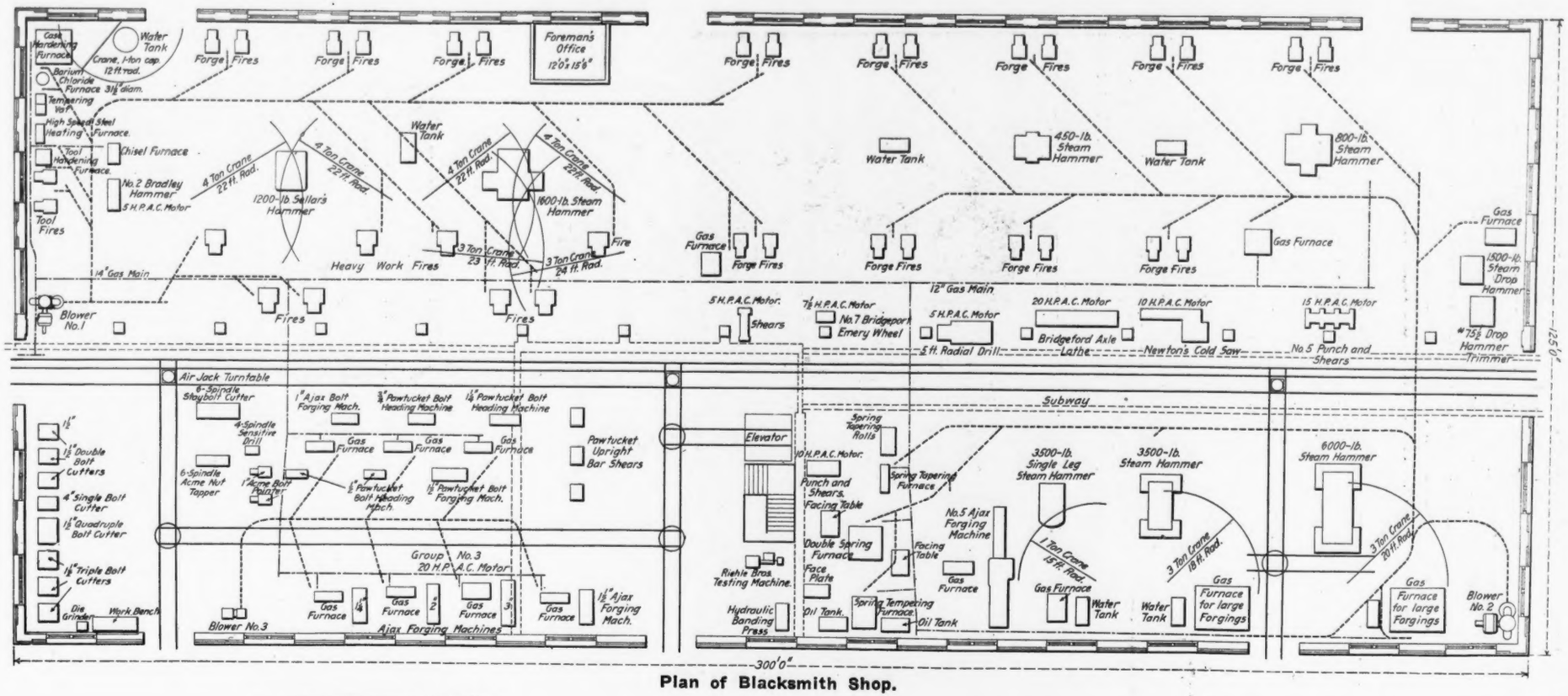
Along the north end of the building there is a gallery whose floor is 23 ft. above the ground. It has a width of 100 ft. and a depth of 64 ft. from the wall. It is upon this platform that the cab work will be done and it will be served by the light cranes of the central bay.

The exterior of the building will be of brick, and the building will be perfectly fireproof throughout. It will contain 35 pits. Between the main pits there are to be auxiliary pits for the storage of the loose parts of dismantled engines. thus keeping the floor clear for the workmen. The rails extend back from the pits into the heavy machinery bay, so that when the engine is raised the wheels and trucks can be rolled back clear of the frames and beneath the traveler that is to take them to the repair point.

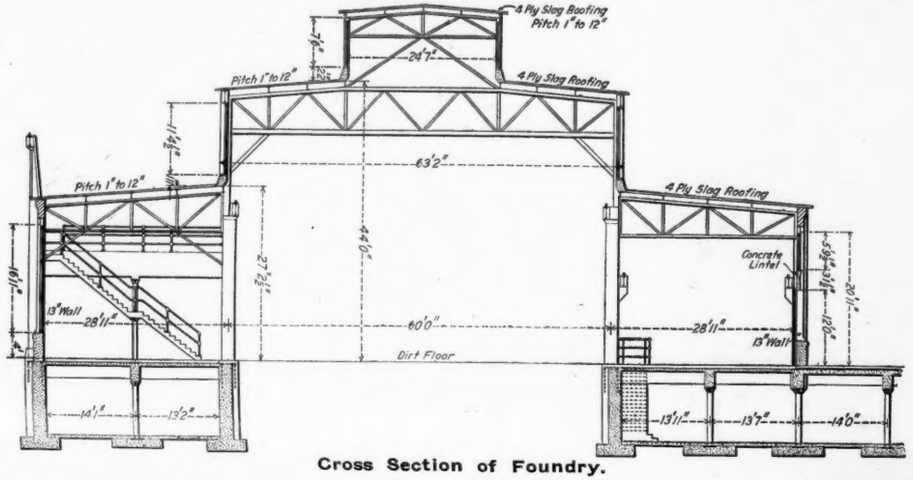
This shop, therefore, is self-contained, and the blacksmith shop and foundry may be regarded as feeders for it.

CLASSIFICATION OF TOOLS.

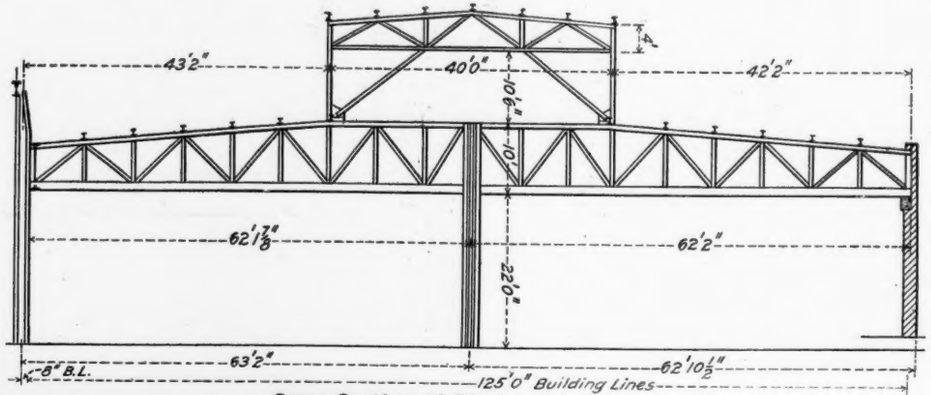
In the arrangement of the tools a classification and method is to be pursued that is highly scientific but somewhat out of the ordinary. Instead of grouping all of certain classes of



Plan of Blacksmith Shop.



Cross Section of Foundry.



Cross Section of Blacksmith Shop.

machines together, such as planers, lathes, drills and shapers, they are to be scattered all over the floor, but grouped for special pieces of work. For example, all the tools that are needed for doing the work on driving boxes will be brought together, and in the same manner, for rods, cylinders, etc. Taking these three as typical of the general plan, we have the following list of tools for the driving boxes:

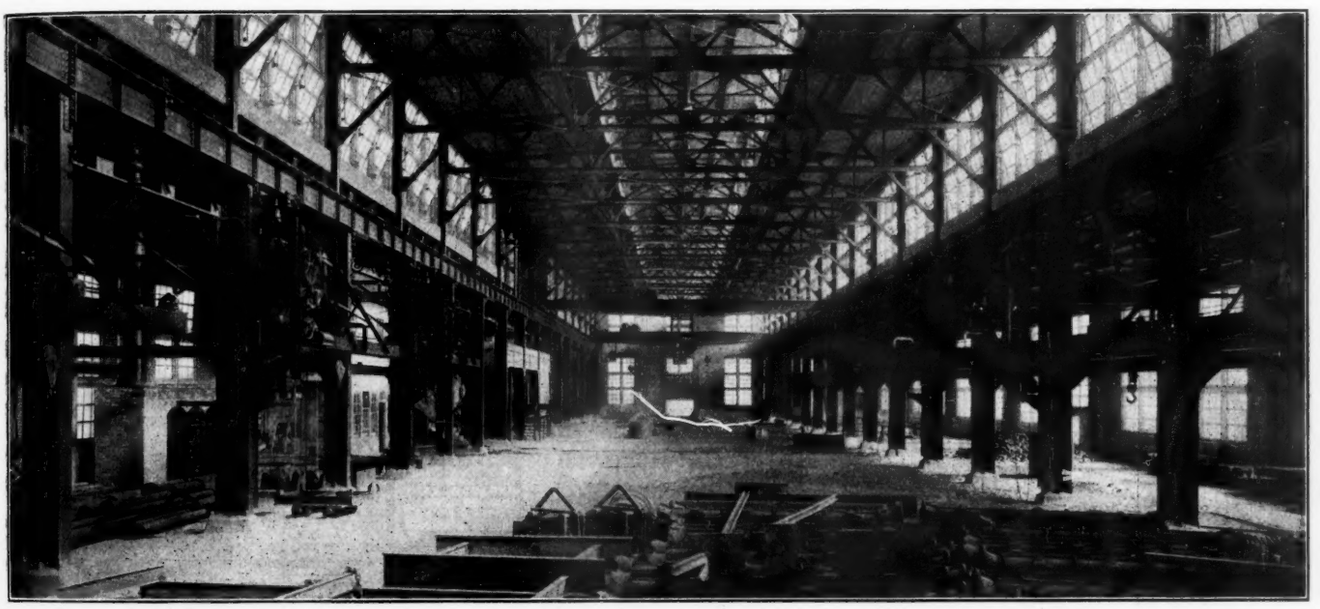
1 42-in. x 42-in. x 20-ft. planer for new work.
1 42-in. x 42-in. x 10-ft. planer for old work.
1 vertical boring mill for brasses
1 railroad draw-shaper for planing boxes for crown brasses.
1 50-in. boring mill for driving boxes.
1 20-in. shaper for cellars and miscellaneous work.
1 3-ft. radial drill.
1 30-in. x 30-in. hydraulic press for crown brasses.

The new boxes coming to this group will go, first to the boring mill, where they will be faced on both sides, thence to the draw-shaper and be shaped for the crown brasses. After this they will be taken to the tinshop and will be babbitted on their two faces. The tools are to be located adjacent to the tinshop, so that this involves no extra handling. The object of doing the babbitting at this stage of the proceeding is to avoid heating and warping the box after the brasses have been fitted and so loosening them. On leaving the tinshop the brass is put in and the cellar fitted. It is then drilled for that babbitt plugs and cellar pins, after which it is planed. Then it goes to the boring mill for the journal fit, and finally to the floor. Meanwhile, the brasses are turned on the vertical boring mill and have their edges finished on the draw-shaper.

For the rod working group there are:

1 43-in. x 14-ft. slab miller.
1 42-in. vertical miller.
1 double-head duplex rod-boring machine.
1 50-in. extra heavy vertical drill.
1 15-in. slotter.
1 heavy 30-in. x 12-ft. planer.
1 pneumatic press.
1 20-in. x 10-ft. lathe for knuckle joint and wrist pins.
1 sensitive drill.

The route of a side rod through this group is first to the slab miller, where it is faced, fluted and finished; second, to the rod-boring machine; third, the vertical miller, where the hubs are milled; fourth, the drill press, where it is drilled for oil holes and grease cups. The main rods go, first, to the slabbing miller, then to the vertical miller, where they are cut off to length. They are then drilled for oil holes. The fourth machine is the slotted for the front end brasses; then they go to the bench for the fitting of the strap and, finally, to the drill press, for drilling the straps.



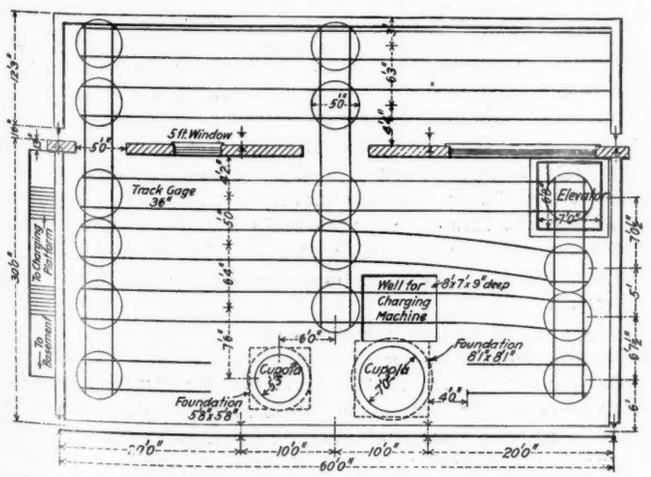
Foundry; Scranton Shops of the Lackawanna.

The group of machines for the cylinders and heads comprises:

1 cylinder boring machine.
1 54-in. x 54-in. x 15-ft. planer.
1 port miller.
1 6-ft. radial drill.
1 54-in. vertical boring mill.

The cylinders go first to the boring mill, then to the planer and finally to the drill. The heads are first turned off in the vertical boring mill and then drilled.

These examples show some of the more simple of the groupings in order to illustrate the general scheme. Some of the groupings are far more complex, as where there will not be work enough of one kind to keep a machine busy all of the time; when operations from two or more processes will be assigned to it, as in the case of the group in which the valve motions will be cared for. The full complement and classification of the work will be taken up and discussed in detail in a future issue.



Plan of Charging Floor of Foundry, Scranton Shops.

SELECTION OF TOOLS.

In the selection of the tools and their classification a great deal of pains were taken. In the first place, a committee was appointed to look into the requirements of the shop. The problem presented was that of the selection of tools capable of doing the heavy repairs on thirty engines per month, in addition to the building of four new ones.

The first step was to analyze and classify all of the work to be done, to choose the proper tool for doing it, and ascertain

the amount of time that would be required for each operation. This done, the several operations were grouped, and where any one failed, in quantity, to keep its tool busy for the month, two or more were assigned to the same tool. From this the list of tools was drawn up, bids were asked on each one and a list of the same made out, at the end of each of which, that is, the bids on each individual tool, the committee recommended the one that, in their opinion, should be bought and their reasons for that opinion; examples of a few of which, to show their character, are taken at random from their report:

"Our reason for selecting this car-wheel lathe is that it is the latest and most improved machine on the market. The latest X machine weighs 45,000 lbs., whereas this one weighs 72,000 lbs. The average time of turning one pair of wheels at the Kingsland shop in the X lathe is 50 minutes. Average time to turn one pair in the lathe recommended 30 minutes.

"In selecting this frame planer we are governed both by the output and the price. The extra heavy A machine shows an economy of $100.80 per year in roughing, the frames for our anticipated requirements, over the standard A machine, but the difference in price, $3,855 at 5 per cent. interest, would cause the expenditure of $192.75 to meet the interest. Therefore, by purchasing the standard machine we have a set saving of $91.95 per year in the roughing cut, as we consider all other cuts equal in both machines."

Again: "We consider this 26-in. by 10-ft. lathe the best machine submitted on account of the large bearings, and the gear on spindle runs in separate bearings. Having no contact with the spindle, no gear pressure is transmitted to the spindle or its bearings, except by the main face. All steel gearing in head with the exception of the large gear, which is semi-steel. (This will be made of steel if desired.) There are six mechanical speed changes for each electrical change.

"The carriage is so arranged as to have the inside of the bed a thrust bearing, so that the thrust of the tool does not come against the vees.

"The tail stock is well clamped. The spindle barrel is also well clamped and the pawl brace keeps the tail-stock from slipping.

"The feed gears are all of steel and the change gear mechanism provides a large range and is obtainable while the lathe is in motion."

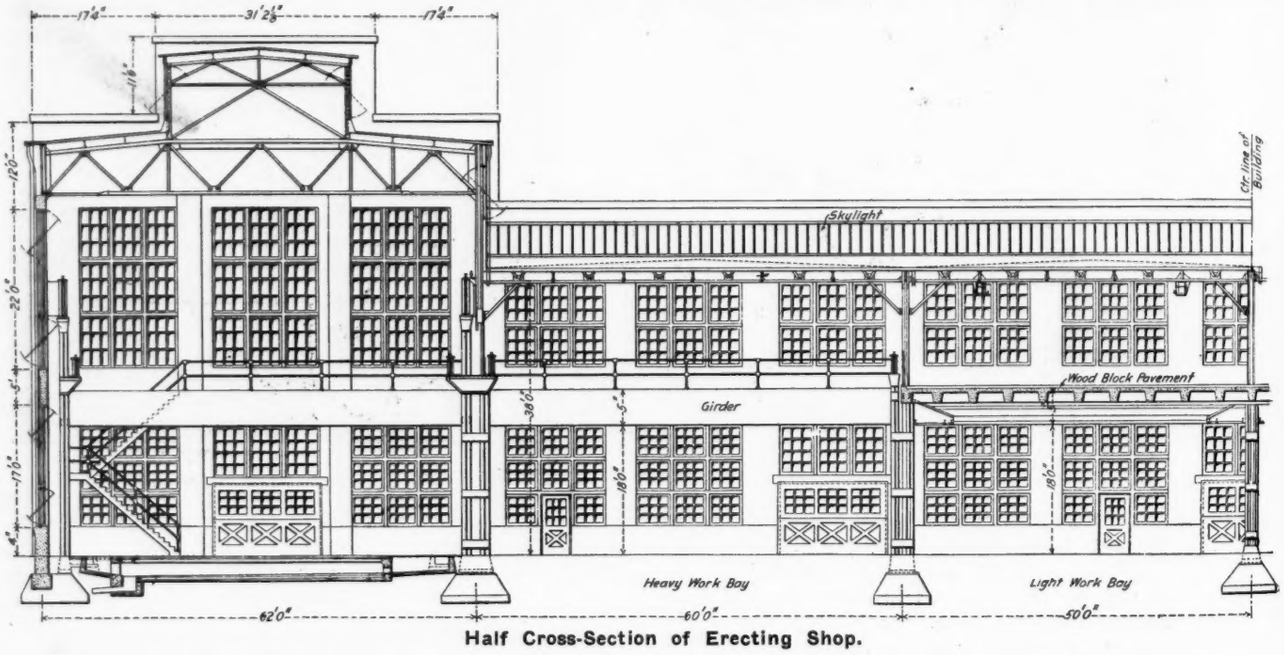
Such recommendations accompanied in detail the bids on each individual machine and go to show the thoroughness with which the work of investigation and selection was done. It can be readily understood, that when these recommendations went up to the authorities no changes were made and the list of tools was purchased as submitted by the committee.

While particular emphasis has been placed at this point on the machine shop tools, the same methods were followed for those of the blacksmith shop, pattern shop and foundry.

FOUNDRY.

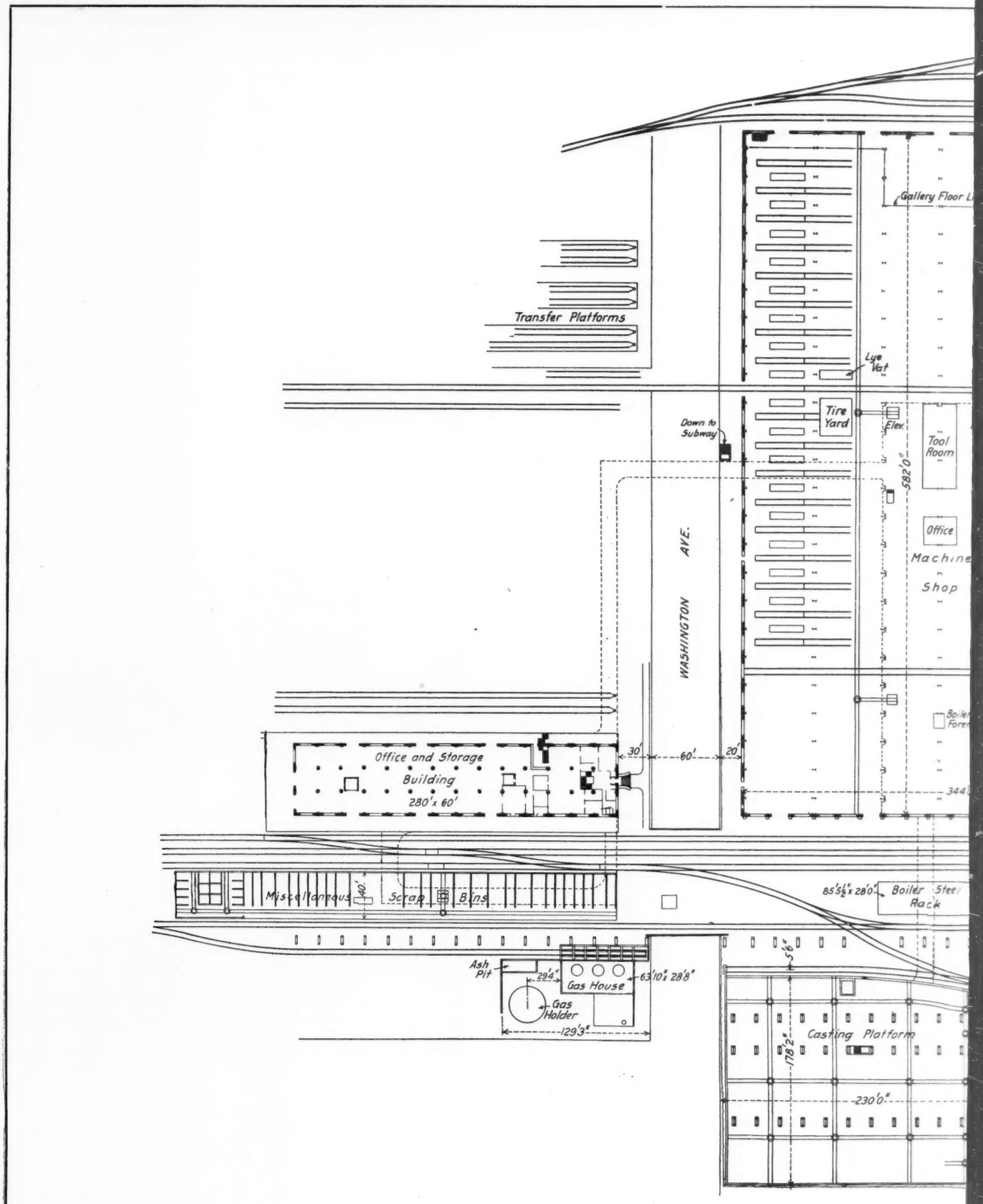
Next to the main building is the foundry, in point of size. It is 400 ft. long and 120 ft. wide. In it will be made all the iron castings that are used upon the road, including the cast iron pipe for the mines as well. Its normal capacity will be 40 tons per day, with an emergency capacity of 70 tons.

The building stands at the extreme southern limits of the property and its floor is about 50 ft. above the level of the adjacent street. It is of reinforced concrete. There are two cupolas of 63-in. and 84-in. diameter, respectively, located at about the center of the building on the north side. The charging floor, elevated office and stairways thereto are of reinforced concrete, the latter being self-supporting. The charging floor has a width of 30 ft. and a length of 60 ft., while outside the building there is an additional platform of the same width and 12 ft. 3 in. wide. This whole platform, with the exception of the space occupied by the cupolas, elevator and charging machine is covered with a network of tracks and turntables for the handling of the material lorries. It is thus possible to raise and store a large percentage of the material needed for a heat in advance. The charging machine is simply a low-lift elevator that lifts a lorrie from the floor and tilts it to a proper angle to discharge the contents so that they will strike at about the center of the bed flush with the leveling doors, through which the bed is trimmed.

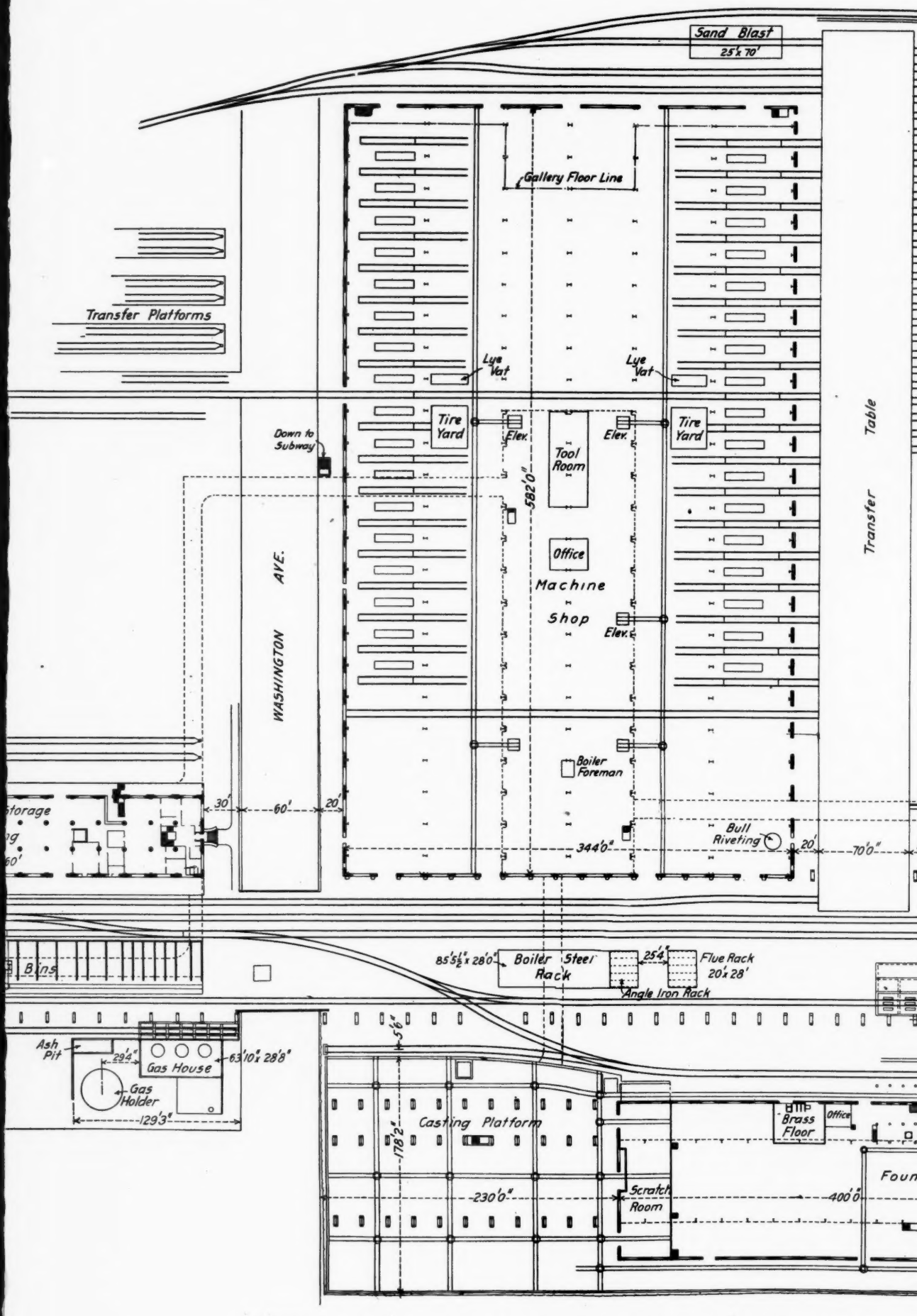


Half Cross-Section of Erecting Shop.

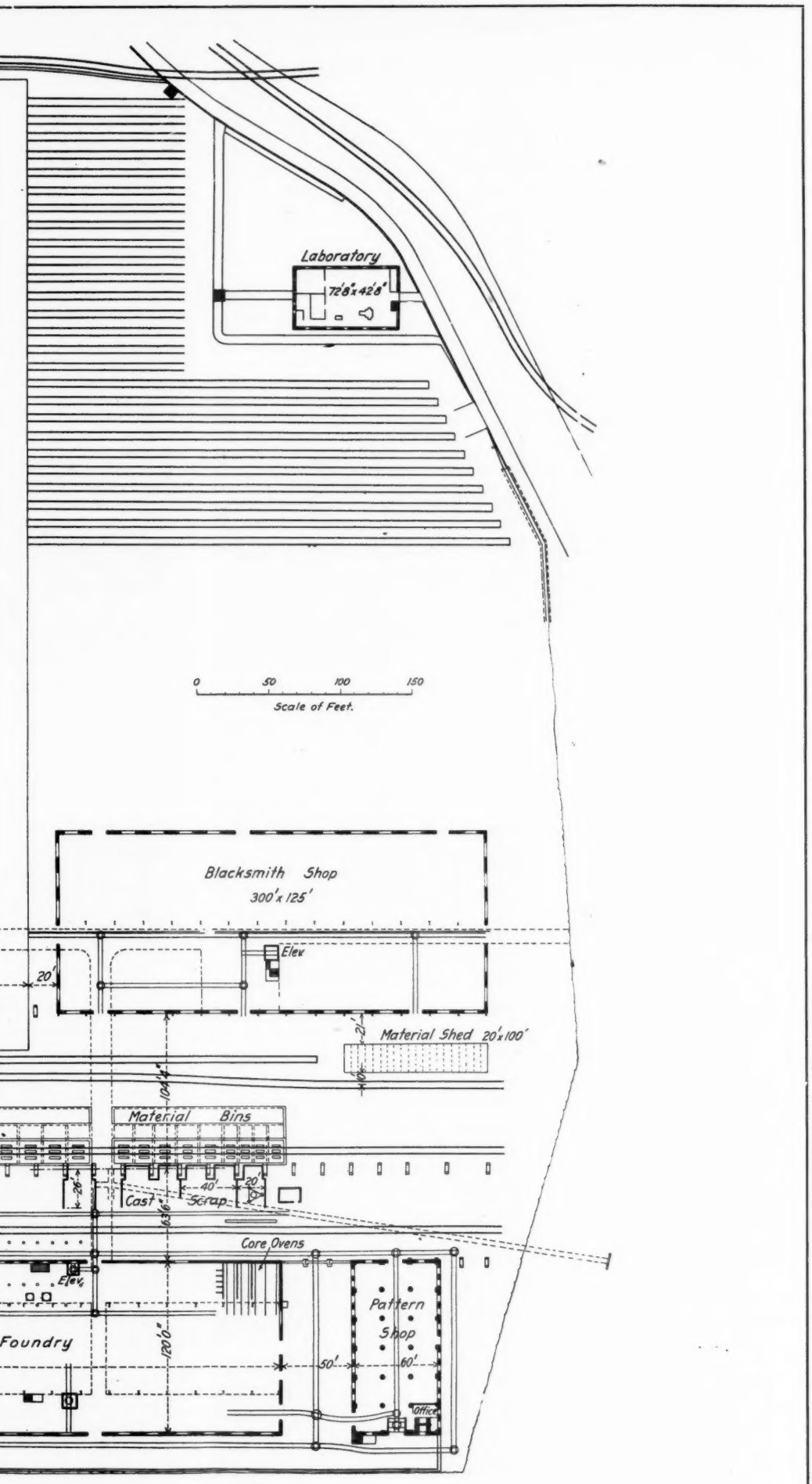
The cross-section of the building shows the type of truss construction used in the roof and also that it is divided into two side bays and a central span. In the bay at the north side there will be located the cupolas, blower room, core room and ovens, the brass floor and the office. On the south side there will be ranged the molding machines for grates, brake-shoe and other work, while in the center and served by one



GENERAL PLAN OF THE NEW LACKAWA



GENERAL PLAN OF THE NEW LACKAWANNA SHOPS AT SCRANTON, PA.


Laboratory
72'8"x42'8"
0 50 100 150
Scale of Feet.
Blacksmith Shop
300'x125'
Elev
20'
Material Shed 20'x100'
104'4"
Material Bins
26'
Cast
40'
Scrap
20'
163'6"
Core Ovens
Elev.
Foundry
120'6"
Pattern
Shop
50'
60'
Office

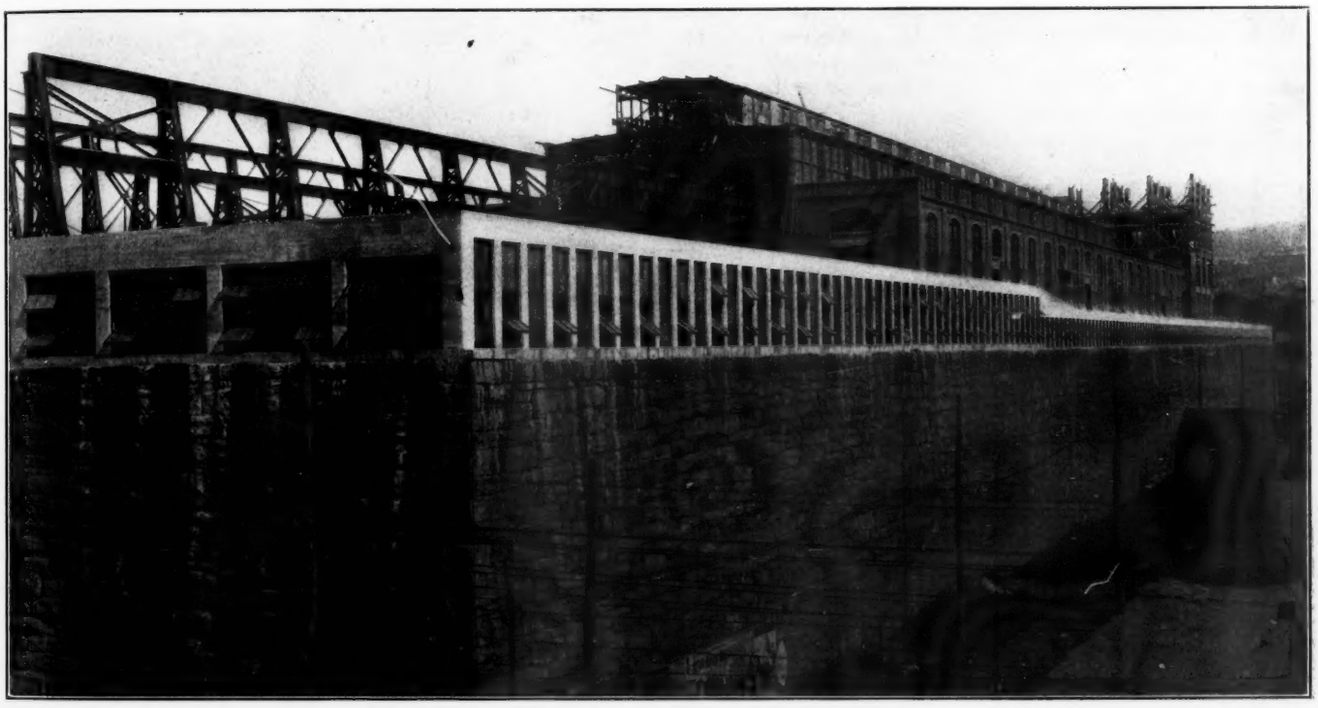
15-ton and two 5-ton cranes, the heavy work will be done. At the east end of this space a portion of the floor is set aside for pipe molding, where the piping for the company's mines will be cast. The south bay, containing the molding machines, is to be served by two five-ton traveling cranes of 25-ft. 6-in. span.

The sand floor over the whole surface of the foundry will have a depth of 7 in. at the sides, of 30 in. at the west end, and of 5 ft. 6 in. throughout most of the length of the center span. At the east end there is a pit with walls of reinforced concrete and of sufficient depth to hold the pipe molds. The shallow depth of sand in the south bay is all that is needed and rests upon a concrete floor, which forms the roof of a subway beneath. It will be seen from the cross-section that there is a subway beneath both of the side bays, the special uses of which will be taken up later. In the case of the foundry, it will be used for the storage of sand and other molding materials, as well as for heating furnaces of the core-ovens.

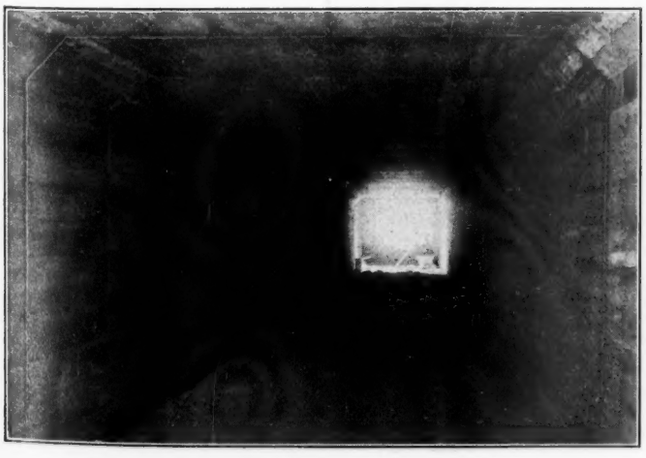
The main floor of the foundry is to be served by five jib cranes of five tons capacity each at 15 ft. and 2½ tons at 25 ft. from the port center. These cranes are fastened to brackets and footings in the sides. They are so arranged that they can be lifted out by the traveling crane and moved from point to point as the exigencies of the work may require.

Across the west end of the building there is a concrete platform elevated above the surface of the floor to that of the main storage platform outside. This will be used for cleaning purposes, and on it the rattlers and other machines will be placed. The rattlers are all provided with fans and dust pipes for the removal and collection of dust. At this end, too, there is a gap in the wall and the upper part opens for the passage of the traveling crane and its load, which can thus pass out over the storage platform. For this purpose the crane runway is carried out beyond the end of the building for a distance of 230 ft.

The platform itself is of reinforced concrete, thoroughly waterproofed and then paved with vitrified brick, and beneath is a large airy subway, to which access is obtained through the three hatchways shown in the general plan.



Machine Shop and Retaining Wall; Scranton Shops.



Subway; Locomotive Shops.

MATERIAL YARD.

North of the foundry, there is a material yard 167 ft. 8 in. wide, to the building line of the blacksmith and machine shops. In this, located as shown, are the bins for cast scrap and pig, boiler steel, angles, flues, bar material and miscellaneous bins. This space will be served not only by tracks over which cars loaded with materials may be run, but also by a traveling crane of 10 tons capacity, which will have a range of 754 ft. or from a line flush with the east end of the blacksmith shop to one flush with the west side of the machine shop. This crane will be used for loading and unloading all material coming to the foundry, and will be fitted with a 42-in. magnetic lift for the purpose. The runway of the crane is carried by 6 columns in the yard for the whole of its length on the north side. On the south, the walls of the foundry and pattern shop are utilized for the purpose of supporting the brackets as far as they will serve. This crane has a span of 60 ft. Beyond it to the north and spanning the balance of the yard space to the walls of the blacksmith and machine shops, is another traveling crane of 10 tons capacity and a span of 104 ft. This also has a greater range of travel than its mate on the foundry side of the yard, as its runway extends out to the west end of the storehouse. Its

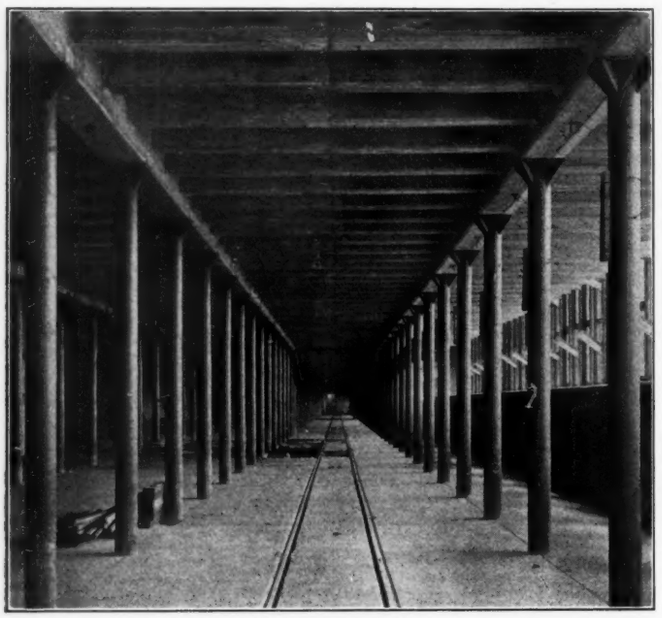
runway is carried by columns on one side and by the shop walls on the other, except for the space between the two shops and across the street, where there are columns. It will be utilized for handling all boiler and blacksmith shop materials, as well as for the transportation of heavy articles to and from the storehouse and loading and unloading trucks in the street beneath the bridge.

PATTERN SHOP.

Fifty feet east of the foundry is the pattern shop. It is of steel construction with reinforced concrete for the lower story and brick facing for the upper three, being four in all, exclusive of the basement. The ground floor, or rather the one on the level with the foundry, will be used as a pattern shop, while those above will be for pattern storage. The whole building is fireproof throughout.

BLACKSMITH SHOP.

North of the foundry and east of the machine shop is the blacksmith shop, a reinforced concrete building, 300 ft. long and 125 ft. wide. The roof is carried by a lattice truss with a line of supporting columns in the center, and is provided with the usual monitor and side openings. The roof itself is



Subway Tram; Machine Shop.

of reinforced concrete slabs, water-proofed and protected in the same manner as the machine shop.

The blacksmith shop tools are grouped in the same general manner as in the machine shop. In the southeast corner there is a large gas furnace for heavy forgings, serving a 6,000-lb. steam hammer. The air for the furnace as well as for the furnaces in the spring department and the light forgings is furnished by a blower having a capacity of 703,000 cu. ft. per hour.

In the spring department there is a complete outfit for making both helical and elliptic springs. Here all the springs used upon the road will be made with the exception of those put under the freight equipment. The western end of the shop on the south side is fitted with air furnaces and upsetting and forging machines, and contains the bolt department, which will have a capacity of 35,000 bolts per day. Close at hand and arranged along the western wall are the bolt cutters, so that there is no lost effort in taking the bolts from the headers to the cutters. This department is furnished with blast by a blower having a capacity of 277,000 cu. ft. per hour.

Across the shop is the frame department. For this work there is a 1,600-lb. steam hammer, about which are clustered

Pattern Shop.

four open fires, with as many jib cranes, each crane so set that it can serve two fires, so that each fire, in turn, is served by two cranes. Beyond this is a 1,200-lb. steam hammer with a group of four heavy-work fires in front of it, while along the north wall to the back, is a row of ordinary open fires.

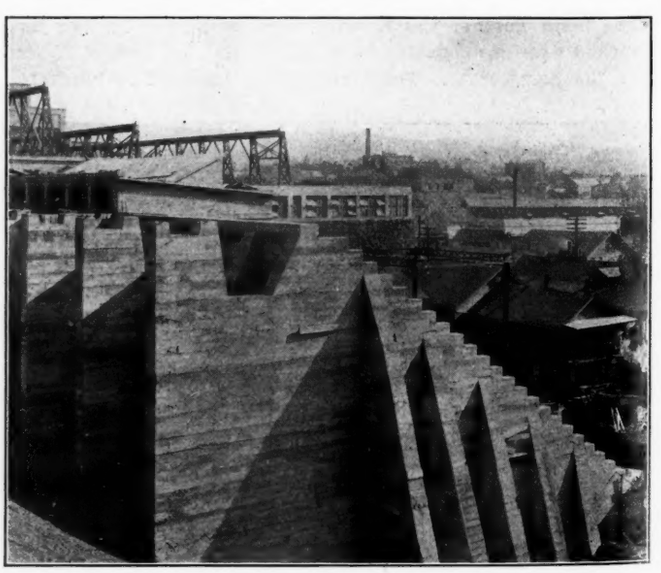
Finally, in the northwest corner and along the western wall, there is a group of tool furnaces, where tool work and case-hardening will be done.

The air for all this section of the shop will be furnished by a blower of 759,000 cu. ft. capacity per hour.

Gas is to be used in all of the furnaces in the blacksmith shop and for that purpose a gas house for the manufacture of water gas has been built across the street and to the west of the casting platform of the foundry. The floor of this building is at the street level and well below that of the tracks and the shop floors, so that the fuel can be dumped into hoppers at the roof of the building and then fed by gravity down into the producers, with no handling at all. For some time the ashes will be used for filling in behind the track retaining wall and the space beyond.

SUBWAYS.

With this review of the shops in general we come next to a feature of the lay-out that is novel, and is rendered easy and economical of construction by the natural topography of

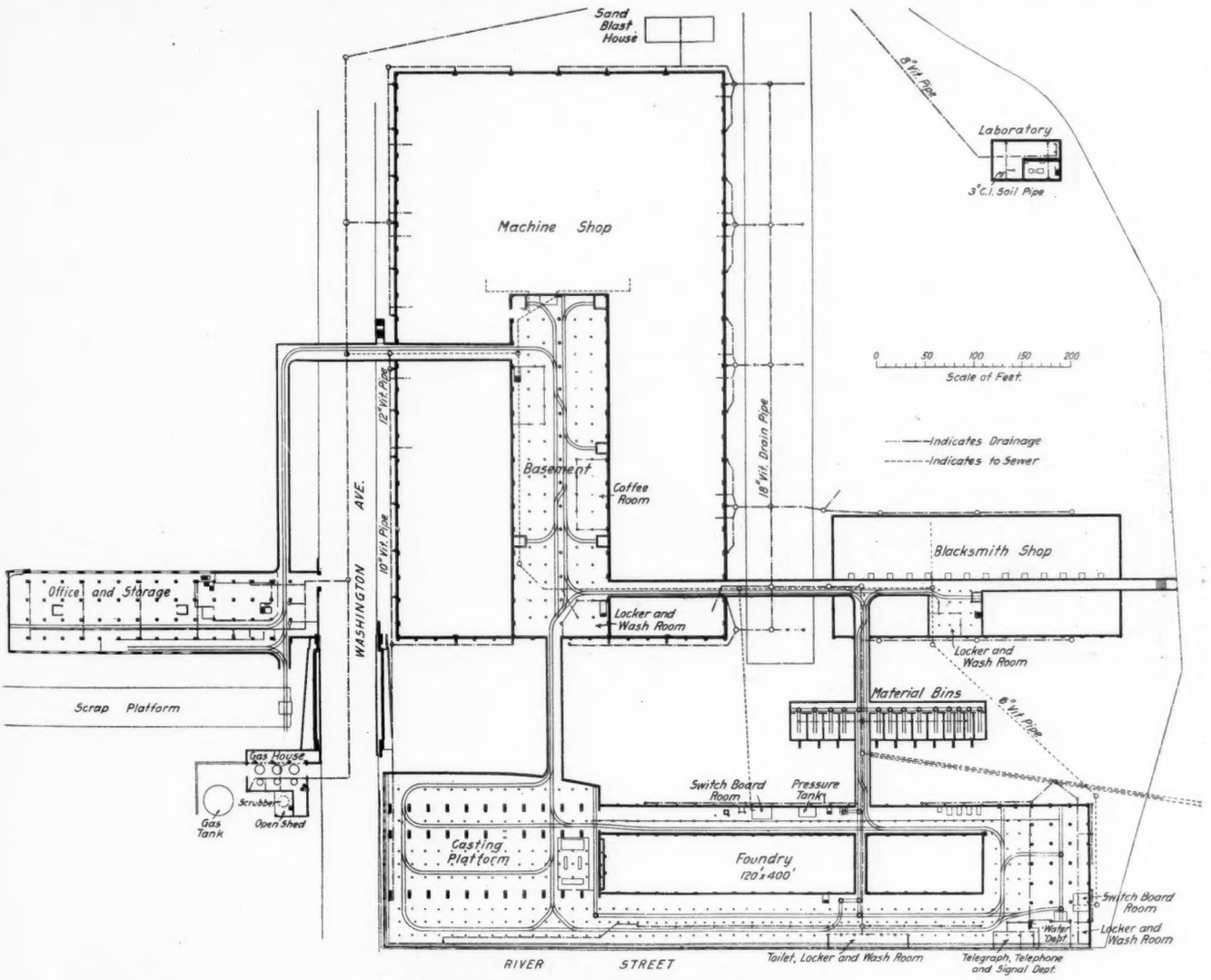


Retaining Wall, Rear of Gas House; Scranton Shops.

the ground. This is the system of subways with which the whole plant is honeycombed.

The ground upon which Scranton is built is very hilly, and, at this place, slopes rapidly down from the railway tracks to the south. It was, therefore, a case of fill or use subways, with all of their advantages. Naturally subways were chosen.

A plan of these subways shows that there is a large basement beneath the south end of the machine shop with a connection across Washington street to a point where a power house may, at some future time, be erected. Another runs south to the large space beneath the casting platform and a third east, and directly through beneath the blacksmith shop to the street beyond. At this point one of the shop gates will be located and the men will there come in to their work.



Plan of Subways of Scranton Shops.

Here beneath the blacksmith shop there is also a large space that will be utilized as a locker and washroom, while from a point a little to the west another subway runs across to the foundry. Here the whole space within the building line, with the exception of that beneath the main central portion of the floor, is occupied by the subway.

As already stated, the subway on the north side will be used for sand storage, core oven furnaces and the like, while that on the south will be utilized as a machine shop for the mining department. It will be remembered that the floor of the foundry is 50 ft. above the street on the south side, so that this subway floor is well up in the air, and windows in the concrete side walls afford ample ventilation and light.

A line of electric railways with an overhead conductor will be laid out through the whole network, and it is by this way that all of the materials passing from one department to another will be handled.

Access to the cars in the subway for the loading and unloading will be through hatchways in the floor, and served by the traveling cranes. These hatchways are generously distributed, there being one even on the bridge over Washington street, so that a truck driven beneath can be loaded or unloaded by the crane which serves the north side of the yard from the east end of the blacksmith shop to the west end of the storehouse, a distance of 1,145 ft.

POWER.

For the present, at least, no powerhouse will be built. All machinery will be driven electrically, either by individual motors or in groups of light machines, according to the necessities of the case, by a current taken from the powerhouse of the company at Hampton.

HEATING.

The heating of the plant will probably be by means of a hot air blast through steam heating coils, and the steam for these latter will be obtained from the present boiler plant of the old shop. This will also serve to furnish the steam for the steam hammers of the blacksmith shop. In order that the fall of pressure and the accumulation of moisture may not be such as to render the hammers inoperative, for the transmission line of piping is about 1,500 ft. long, the steam will be superheated to 510 deg. Fahr., at a pressure of 150 lbs., which will give a superheat of 145 deg. It is expected that

this will be more than enough to take care of the radiation and loss of pressure so that at least good dry saturated steam will be delivered to the hammers.

SAND BLAST.

Another building closely allied to the economical maintenance of the engines is that used for sand-blasting the tanks prior to painting them. This method of preparation and cleaning has been used on the road for some time and has been found to effect great economies by the increase that it has made in the time between paintings. The building for the purpose is of reinforced concrete and is located on the north side of the main building.

LABORATORY.

The physical and chemical laboratory is east of the machine shop and is of reinforced concrete.

STOREHOUSE.

The storehouse is also of reinforced concrete, located on the west side of Washington street, opposite the machine shop. This building is to measure 280 ft. by 60 ft., and will contain not only the storehouse but the offices for those connected with the motive power department and the administration of the shop.

DISTRIBUTION OF WORK.

The general distribution of the work among the tools of the shop will be taken up in detail in a future article. Meanwhile the following is the list of tools that has been provided for the rated capacity of 30 locomotives in general repairs, and four new locomotives per month. Not all these tools have been bought yet, as they will not be needed at once, but space has been reserved for them on the floor of the shop so that they can be put in their proper place when needed.

MACHINE SHOP TOOLS.

1 80-in. D. W. lathe, new (Niles-Bement-Pond Co.).
1 D. W. lathe, old (Niles-Bement-Pond Co.).
1 7-ft. vertical boring mill, old (Niles-Bement-Pond Co.).
1 quartering machine, old (Niles-Bement-Pond Co.).
1 7-ft. vertical boring mill (Niles-Bement-Pond Co.).
1 400-ton wheel press (Niles-Bement-Pond Co.).
1 planer 72 in. x 32 ft. (4 heads) (Niles-Bement-Pond Co.).
1 2-head frame slotter (4 per setting) (Wm. Sellers & Co., Inc.).
1 4-head frame drill (Edw. Harrington Son & Co.).
1 lathe, 32 in. x 14 ft. 6 in. (Niles-Bement-Pond Co.).
1 double keyway cutter (Newton Machine Tool Co.).
1 slab miller, 48 in. x 4 ft.; to mill 14 ft. in length (Niles-Bement-Pond Co.).
1 42-in. vertical milling machine (Niles-Bement-Pond Co.).
1 D. H. rod boring machine (Newton Machine Tool Co.).
1 extra heavy high-duty drill press, 44 in.; compound table (Niles-Bement-Pond Co.).
1 12-in. heavy slotter (Wm. Sellers & Co., Inc.).
1 extra heavy planer, 4 heads; 30 in. 12 ft. (Niles-Bement-Pond Co.).
1 hydraulic press for bushings (R. D. Wood & Co.).
1 lathe, 20 in. x 10 ft. (Hendey Machine Co.).
1 26-in. x 10-ft. lathe (Lodge & Shipley Mch. Tool Co.).
1 extra heavy planer, 4 heads; 30 in. 12 ft.(Niles-Bement-Pond Co.). Co.).
1 planer, 42 in. x 20 ft. (Niles-Bement-Pond Co.).
1 planer, 42 in. x 10 ft. (Niles-Bement-Pond Co.).
1 37-in. rapid production vertical lathe (Bullard Machine Tool Co.).
1 20-in. draw shaper (Morton Mfg. Co.).
1 37-in. vertical boring mill (Niles-Bement-Pond Co.).
1 20-in. shaper, heavy duty (Cincinnati Shaper Co.).
1 3-ft. radial drill (Western Machine Tool Works.).
1 cylinder boring mill (Niles-Bement-Pond Co.).
1 planer, 54 in. x 15 ft. (Niles-Bement-Pond Co.).
1 port miller.
1 5-ft. radial drill (Niles-Bement-Pond Co.).
1 50-in. vertical boring mill (Niles-Bement-Pond Co.).
1 lathe, 26 in. x 12 ft. (Niles-Bement-Pond Co.).
1 gap grinder (Landis Tool Co.).
1 cottering machine (Niles-Bement-Pond Co.).
1 horizontal milling machine, 22 in. x 10 ft. (Niles-Bement-Pond Co.).
1 80-in. x 20-in. guide bar grinder (Bridgeport Safety Emery Wheel Co.).
1 shaper, 16-in. (Cincinnati Shaper Co.).
1 lathe, 16 in. x 6 ft (Hendey Machine Co.).
1 42-in. vertical boring mill (Niles-Bement-Pond Co.).
1 planer, 30 in. x 8 ft. (Niles-Bement-Pond Co.).
1 planer, 36 in. x 12 ft., D. H. (Niles-Bement-Pond Co.).
1 3-ft. radial drill (Western Machine Tool Works).
1 heavy plain horizontal milling machine, 14-in. x 6-ft. table (Milwaukee Machine Tool Co.).
1 lathe, 24 in. x 14 ft. (Niles-Bement-Pond Co.).
1 slotter, 20 in. (Wm. Sellers & Co., Inc.).
1 lathe, 32 in. x 12 ft. (Lodge & Shipley Machine Tool Co.).
Lathes—1 18-in. x 10-ft.; 1 20-in. x 10-ft. (Hendey Machine Co.).
Turntable connecting machine; capacity, 4 in. (Manning, Maxwell & Moore).
1 3-in. x 36-in. turret lathe (Warner & Swasey Co.).
1 horizontal boring mill, 4-in. spindle; 6-ft. table (Niles-Bement-Pond Co.).
1 planer, 30 in. x 10 ft., D. H. (Niles-Bement-Pond Co.).
1 special horizontal milling machine, 30 in. x 10 ft. (Niles-Bement-Pond Co.).
Vertical milling machines—1 42-in. table, height of spindle 25 in.; 1 26-in. x 10¼-in. diam. rotary table, 17 in. (Lodge & Shipley Machine Tool Co.).
1 crank flanger, 20 in. x 20 in. x 24 in. (Newton Machine Tool Works).
1 3-ft. radial drill (Niles-Bement-Pond Co.).
1 26-in. vertical drill (Niles-Bement-Pond Co.).
1 37-in. vertical rapid production lathe (Bullard Machine Tool Co.).
1 car wheel boring mill, 48-in. facing attachments (Wm. Sellers & Co., Inc.).
1 steel tired wheel lathe, 48 in. (Wm. Sellers & Co., Inc.).
1 planer, 36 in. x 10 ft. (4 heads) (Wm. Sellers & Co., Inc.).
1 4-ft. radial drill (Western Machine Tool Works).
1 wheel press, 200-ton (Niles-Bement-Pond Co.).
1 36-in. x 12-ft. planer (Wm. Sellers & Co., Inc.).
1 30-in. x 20-in. x 24-in. crank planer (Newton Machine Tool Works.).
1 3-ft. radial drill (Niles-Bement-Pond Co.).
1 3-ft. radial drill (Niles-Bement-Pond Co.).
1 lathe, 16 in. x 6 ft. (Lodge & Shipley Machine Tool Co.).
1 lathe, 14 in. x 6 ft. (Lodge & Shipley Machine Tool Co.).
Turret lathes—2 18½-in. x 6-ft.; 1 20-in. x 6-ft. 6-in.; 1 18½-in. x 6-ft. (American Tool Works Co.).
1 vertical milling machine (Lodge & Shipley Machine Tool Co.).
1 37-in. vertical rapid production lathe, 4 jaws (Bullard Machine Tool Co.).
1 lathe, 18 in. x 6 ft. (Hendey Machine Co.).
1 37-in. vertical rapid production lathe (Bullard Machine Tool Co.).
1 planer, 48 in. x 12 ft. (Wm. Sellers & Co., Inc.).
1 32-in. vertical drill (Niles-Bement-Pond Co.).
1 5-ft. radial drill (Niles-Bement-Pond Co.).
1 slotter, 18-in. (T. C. Dill Machine Co., Inc.).
1 planer, 36 in. x 10 ft. (Niles-Bement-Pond Co.).
1 4-ft. radial drill (Niles-Bement-Pond Co.).
1 Lassiter 6-spindle threading machine (Walter H. Foster Co.).
1 4-spindle drill.
1 6-in. Pond turret machine (Niles-Bement-Pond Co.).
1 4-in. Gisholt machine (Gisholt Machine Co.).
4 jack chuck.
Turret lathes—1 (new) 3-in. x 36-in.; 1 (new) 2½-in. x 24-in.; 3 2-in. x 24-in. (Warner & Swasey Co. and Gridley).
1 4-head Lassiter bolt turning machine (Walter H. Foster Co.).
1 2-in. centering machine (Pratt & Whitney Co.).
1 2-in. bolt pointer (National Machinery Co.).
2 lathes, 12 in. x 5 ft. (old).
3 portable lathes, 12 in. x 5 ft. (old).
1 37-in. rapid production vertical lathe (Bullard Machine Tool Co.).

TOOL ROOM.

1 universal milling machine (Milwaukee Machine Tool Co.).
1 plain milling machine, 14 in. x 6 ft. (Milwaukee Machine Tool Co.).
3 lathes—2 14 in. x 6 ft., 1 12 in x 6 ft. (Hendey Machine Co.).
1 drill press, 24 in., heavy duty compound table (Niles-Bement-Pond Co.).
1 13-in. friction drill (Prentice Bros. Co.).
1 16-in. shaper (Mark Flather Planer Co.).
1 crank shaper, 24½-in stroke (Newton Machine Tool Works).
1 Gisholt tool grinder (Gisholt Machine Co.).
1 Sellers tool grinder (Wm. Sellers & Co., Inc.).
1 reamer grinder (Morse).
1 cutter grinder (O. S. Walker & Co.).
1 die grinder (National Machinery Co.).
2 twist-drill grinders (American Tool Works Co.).

BOILER SHOP.

1 60-in. throat punch (Cleveland Punch & Shear Works).
1 36-in. throat shear (old) (Long & Allstatter Co.).
1 bevel shear (old) (Long & Allstatter Co.).
1 60-in. throat punch (old) (Long & Allstatter Co.).
1 36-in. throat punch (old) (Long & Allstatter Co.).
1 16-in. throat punch (old) (Long & Allstatter Co.).
1 punch and shear, and 25-ft. spacing table (Niles-Bement-Pond Co.).
1 flange punch (old).
1 hydraulic flange press (Chambersburg Engineering Co.).
1 15-ft. bending rolls (old) Niles-Bement-Pond Co.).
1 8-ft. bending rolls (old) (Niles-Bement-Pond Co.).
1 plate planer (Wm. Sellers & Co., Inc.).
1 hydraulic cap riveter (Chambersburg Engineering Co.).
1 6-ft. radial drill (Niles-Bement-Pond Co.).
1 horizontal drill (Beaman & Smith Co.).
1 4-spindle drill (Foote-Burt Co.).
1 flue rattler.
1 cutting-off machine for safe ends (Fox Machine Co.).
2 flue cutting-off machines (Fox Machine Co.).
2 D. H. welding machines.
1 power clamp (Hilles & Jones Co.).
Total number machines, 23.

BLACKSMITH SHOP TOOLS.

Punch and shears (Hilles & Jones, No. 5).
Cold saw and cutting-off machine (Newton's No. 9).
Axle lathe (Bridgeford).
60-in. radial drill (Niles-Bement-Pond Company).
No. 7 Bridgeport emery wheel.
Round iron shears (Long & Allstatter) (old).
Bliss drop hammer trimmer, No. 75½ (old).
3-in. Bliss drop hammer trimmer (old).
2-in. Bliss drop hammer trimmer (old).
1½-in. Bliss drop hammer trimmer (old).
1-in. Bliss drop hammer trimmer (old).
1½ Pawtucket bolt forging machine.
1¼ Pawtucket bolt forging machine.
¾ Pawtucket bolt forging machine.
½ Pawtucket bolt forging machine.
2 1-in. Acme bolt pointing machines.
3 1½-in. triple bolt cutters (2 old).
3 1¼-in. double bolt cutters.
1 1½-in. quarduple bolt cutter.
1 4-in. single bolt cutter.
6 spindle Acme nut tapper.
6 spindle staybolt cutter.
4 spindle staybolt drill.
Riehle Bros. 50,000-lb. screw testing machine.
Tinius & Olsen spring banding (hydro.) press.
2 No. 1 Pawtucket bar shears.
1 No. 2 Pawtucket bar shears.
Punch and shears, Spring Dept.
Tapering rolls, Spring Dept.
6,000-lb. steam hammer, (N.-B.P.).
3,500-lb. steam hammer (old). (N.-B.-P.).
1,600-lb. steam hammer (N.-B.-P.).
1,200-lb. steam hammer (Wm. Sellers) (old).
1,500-lb. drop forging steam hammer (N.-B.-P.).
800-lb. steam hammer (N.-B.-P.).
450-lb. steam hammer (N.-B.-P.).
Bradley Cushioned hammer.

SHOP KINKS.

SEVENTH COLLECTION (FIRST PRIZE)

BY D. P. KELLOGG,
Master Mechanic, Southern Pacific Co., Los Angeles Shops.
COLLECTION SIGNED ALSO BY W. F. MERRY AND G. H. GOODWIN
General Foreman and General Gang Foreman.

DRIVING-BOX CARRIER.

Fig. 1 shows a device which has been very helpful in moving driving-boxes from place to place about the shops, as necessity requires, while being handled by the different departments. Anyone who has tried to handle a driving-box on the ordinary shop truck knows what a hard job it is, and will appreciate the use of a carrier of this kind. It is another advantage, in that it can always be found, for it cannot be used for any other kind of trucking.

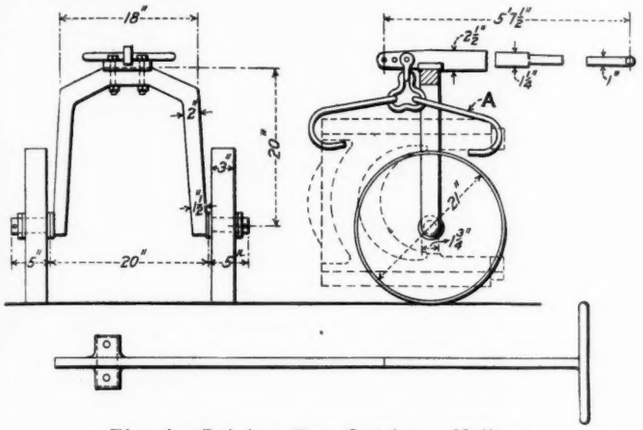


Fig. 1—Driving Box Carrier. Kellogg.

CARRYING DRIVING-WHEEL TIRES.

Fig. 2 illustrates a driving-wheel carrier. This carrier and a tire of the largest size can be handled with ease with three or four men, while the old method of rolling tires requires six or seven men, with the ever-present danger of injuring some one. The drawing gives in detail all that is necessary

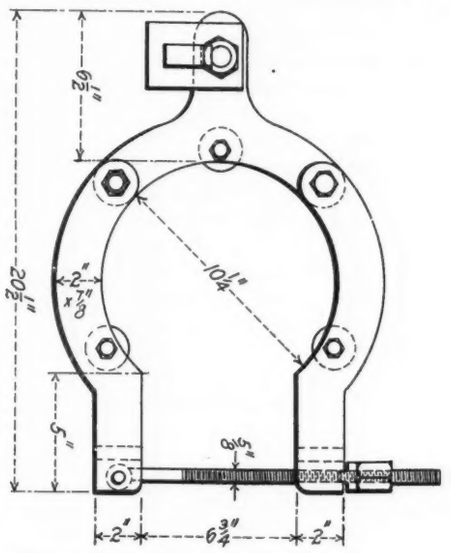


Fig. 3—Burnishing Tool for Driving Wheel Journal. Kellogg.

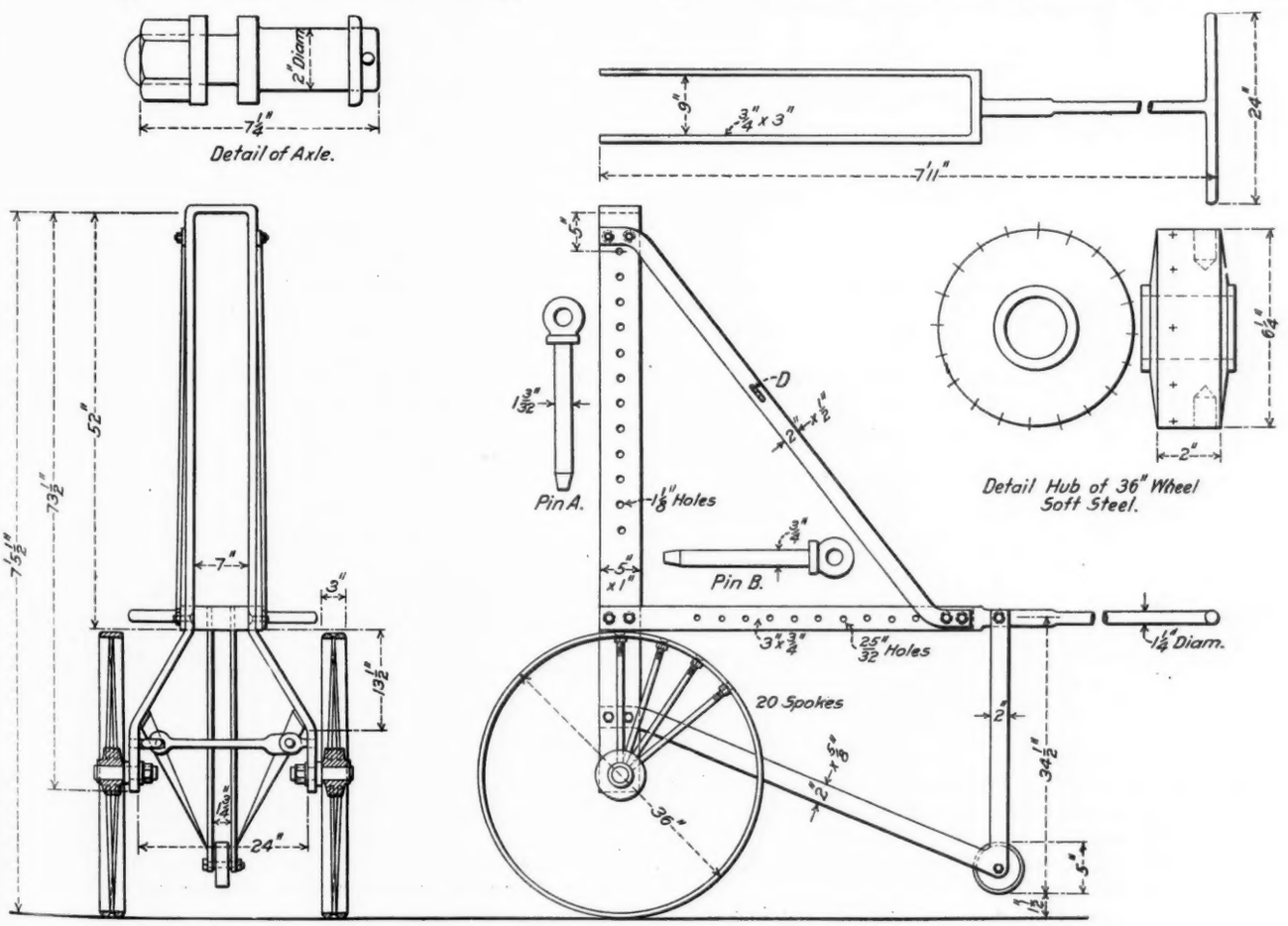


Fig. 2—Driving Wheel Carrier. Kellogg.

for building it. As will be seen, the wheels are built up and can be made in any shop. Our carrier has been in service over a year, and the wheels are in just as good shape as when built. The tire is hung on the pins shown.

ROLLING TOOL.

Fig. 3 illustrates a burnishing tool for driving-wheel journals, with three rollers. Most rollers are set in a jaw, making them useless for burnishing next to the shoulder. This tool overcomes this difficulty by putting all rollers in the outside of the frame, thus allowing the rolls to go into a corner without any trouble. A smaller tool of the same style has been built for burnishing piston rods, and both are giving excellent satisfaction.

TELESCOPIC PNEUMATIC HAMMER.

Another good tool is shown in Fig. 4—a telescopic pneumatic hammer. This hammer has proved a time-saver, not only for knocking out bolts from the frames of locomotives, but for knocking all crown-bar bolts, effecting a saving alone on this one job of 200 per cent. To operate this hammer after the hose has been connected and mounted on substantial blocks, open the lower cock. This admits air under the telescope cylinder and holds the punch on the objecst to be knocked out. Then open the top cock quickly. This will admit air through the ⅛-in. holes in the telescope cylinder, causing that hammer to lift and hit a very hard blow. Then shut off the cock again to release the air, which exhausts the holes in the sides of the cock. The hammer will then drop on the rubber seat shown as a cushion. The hammer will hit as fast as the operator can work the cock. The weight of the hammer is 24 lbs.

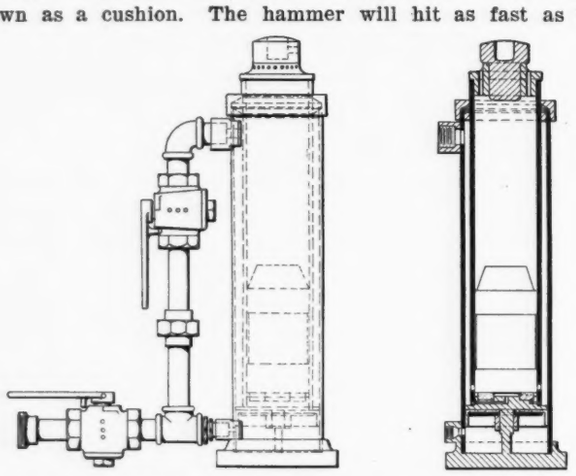


Fig. 4—Telescopic Pneumatic Hammer. Kellogg.

CYLINDER ATTACHMENT FOR AIR MOTORS.

Fig. 5, shows a very handy machine for drilling tell-tale holes in staybolts. By applying an air cylinder to a small motor it acts as an air feed, always keeping the drill in line from where it starts. The old method of drilling tell-tale holes after the staybolts were in the boiler was a very hard job, because the operator had to push the drill 1¼ in. on each staybolt, and a little movement either way when the drill is in the bolt will break the drill. Any man who has had to drill staybolts in the boiler will concur in this statement.

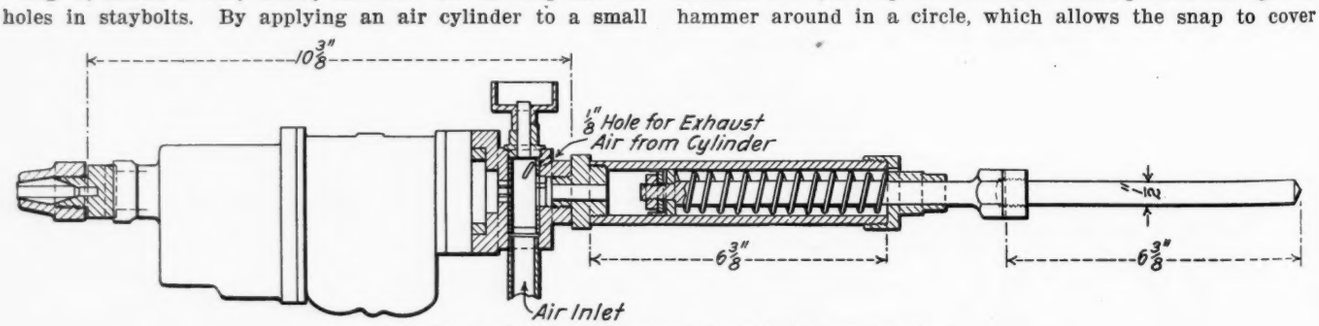


Fig. 5—Cylinder Attachment for Air Motor. Kellogg.

Our method of drilling holes with this machine is very simple. Use two high horses, and tie with pieces of wire from some convenient place at the top of horses to one boiler. Then set the board perpendicular, and it can be moved along the line of bolts to be drilled. The operator can sit down and drill a staybolt in 20 seconds. Our cost of drills has been reduced 50 per cent. and labor reduced 40 per cent., besides making it easy for the driller.

PNEUMATIC HOLDER-ON.

Fig. 6 shows a neat and effective contrivance for holding long-stroke hammers for overhead work. The weight of these hammers averages from 25 to 30 lbs. each, making it a hard job to hold them up. After completing one of these devices they were so satisfactory that we made two more. Note the range that can be covered without changing position. We find this very useful in crown-bar bolts. Instead of hammering the bolts down with hand hammers, we have a shallow snap to fit the hammer, and work them down with the device shown. There is tension enough in the spring to hold the hammer and yoke up to the sheet. The operator swings the hammer around in a circle, which allows the snap to cover the bolts down with hand hammers, we have a shallow ball shown on the hammer allows the operator to work on an angle when circumstances call for it. This device saves much hard work.

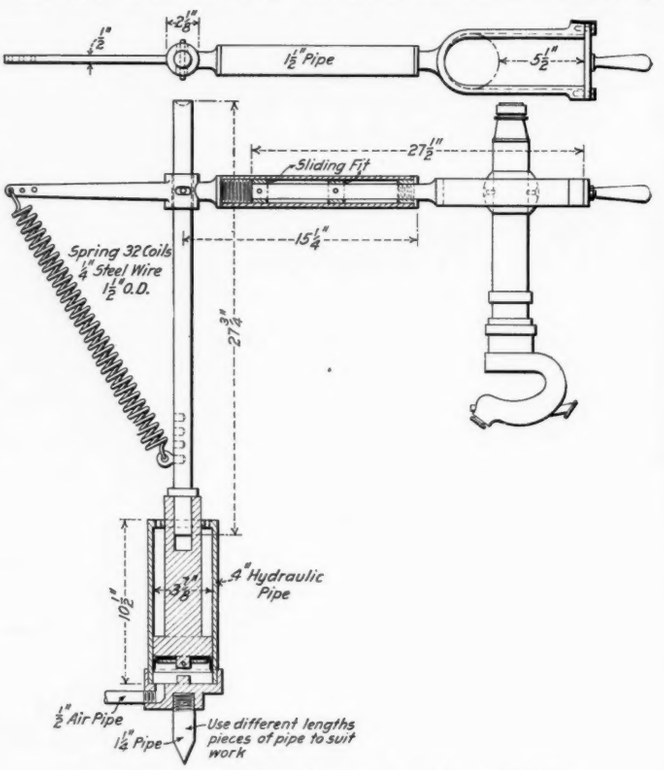


Fig. 6—Pneumatic Hammer Holder. Kellogg.

STAND TO BE USED IN CONJUNCTION WITH AIR MOTOR FOR TAPPING CUT HOLES.

Fig. 7 shows a spring stand used in connection with air

motors for hard work, such as reaming and tapping for crown bolts. It always takes a very powerful machine to do this work, especially when the crown bolt is tapered. These machines weigh 60 lbs. It required one boilermaker and two helpers to hold this machine. Every time they changed position from one hole to another they had to lay the motor down and lift it up again. The picture shows the motor connected. The springs are made with enough tension to hold up the motor, and can be pulled down to be transferred to another hole. The spring tension will also allow the motor to follow this tap without crowding it. With this stand we do the work with one less man. It is light in construction; one man can carry it, and it does not take up much room. It can be regulated to any height by applying different length extensions.

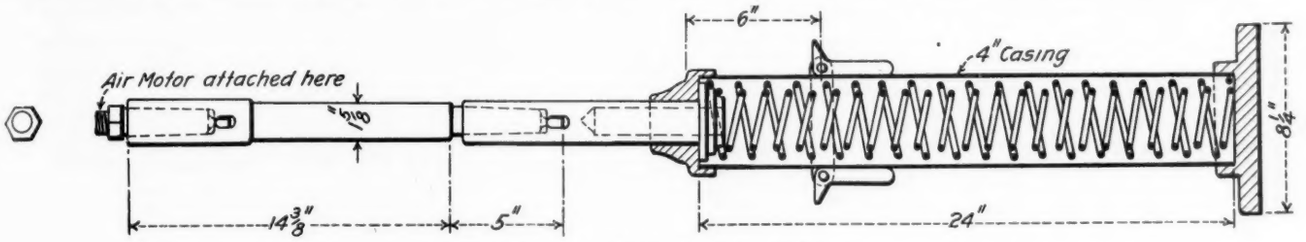
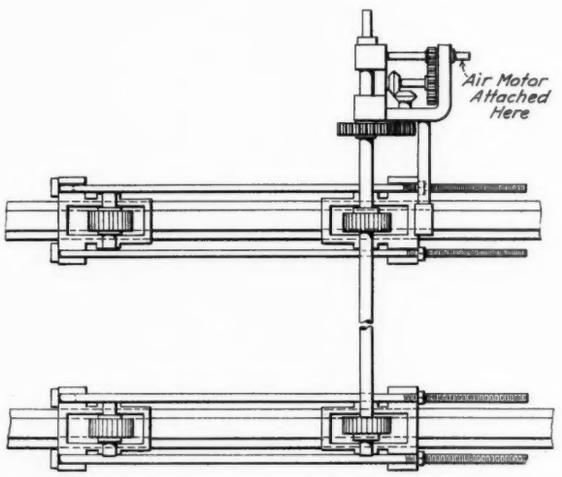


Fig. 7—Air Motor Stand. Kellogg.



Application and Arrangement of Valve Setting Machine.

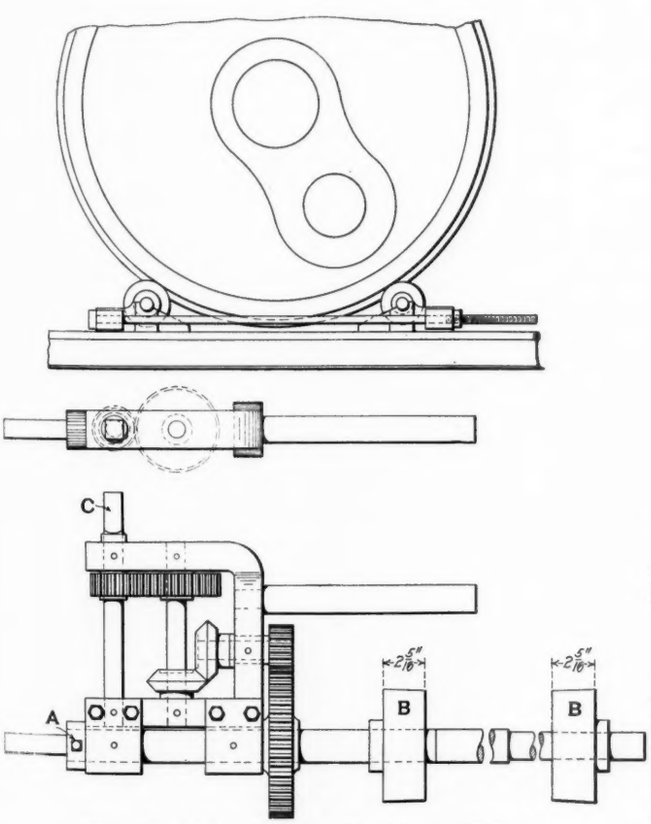


Fig. 8—Valve Setting Machine. Kellogg.

VALVE SETTING MACHINE.

Fig. 8 shows a unique valve setting machine. There are several different kinds of valve setting machines, but we have never seen one applied so readily as the one shown. The main feature of this machine is the gear box. It is light in construction, but very effective. It is geared six to one, allowing the driving-wheel to travel about 15 ft. per minute. To detach it from the shaft, when under the engine, loosen set screw collar A located at end of shaft. This being done, the gear box can be removed by sliding it out from under wheel along the shaft. The gears are all covered with a neat case made from No. 14 iron. Power is transmitted from air motor.

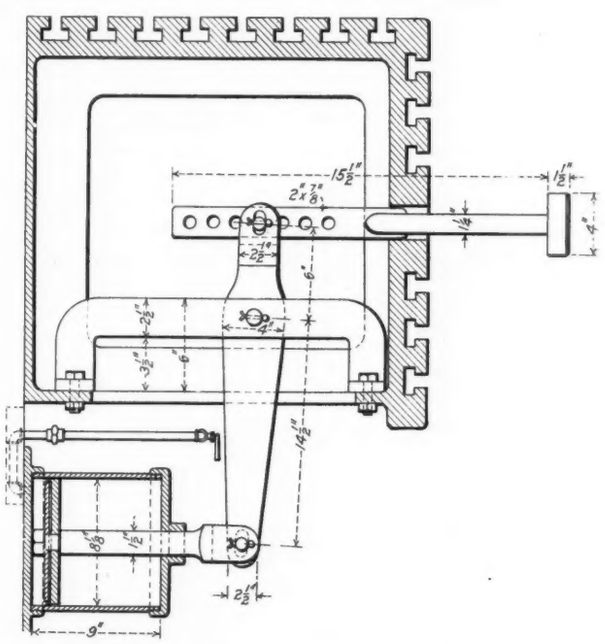


Fig. 10—Pneumatic Clamp Applied to Drill Press. Kellogg.

OUTFIT FOR HANDLING AIR HOSE.

Fig. 9 shows a complete outfit for handling the air hose used on locomotives and cars. Without exception, we think we can handle and equip more hose than any other railway shop in the country. We have a chute on one end of the bench. The hose are all cut to proper lengths when received. The two clamp rings are put on, and then they are put on the chute and roll down to the operator at section I-J. The hose is clamped; he then puts coupling and nipple

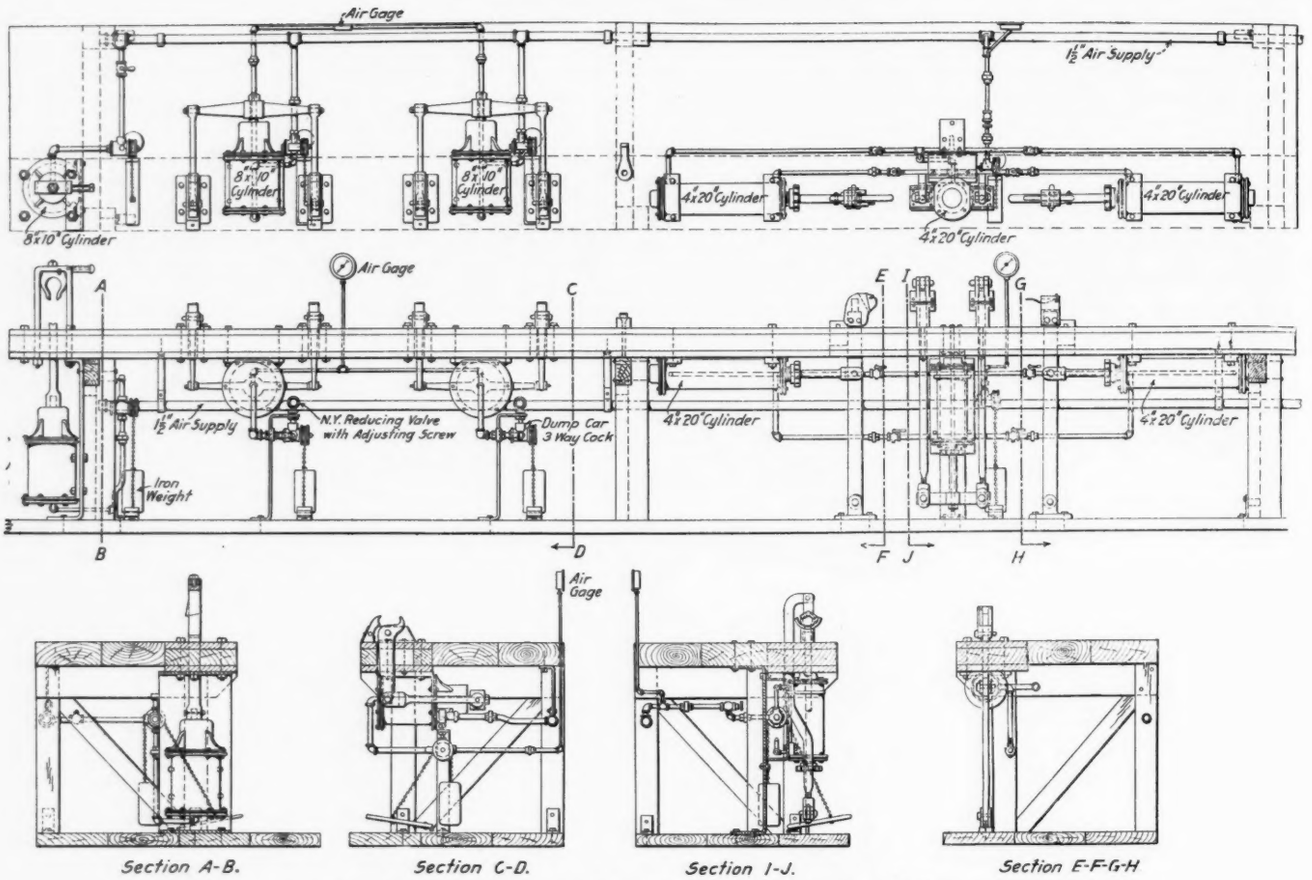


Fig. 9—Bench Equipment for Fitting Up Air Hose. Kellogg.

in a carrying arm; with his foot he opens throttle and both the connecting arms are pressed in the hose at the same time. They are transferred to another chute and go to the air clamps shown in C-D. These clamps hold the hose, while the operator tightens the clamp screws by means of the flexible shaft. The hose pass through section I-J at the rate of 300 per hour; that is, putting on 300 couplings and 300 nipples, or a total of 600 ends per hour. We also have a knife arranged with air cylinder by which we cut old hose to detach connections. The hose can be cut and connections taken out just as fast as the operator can handle them.

PNEUMATIC CLAMP APPLIED TO DRILL PRESS.

Fig. 10 illustrates a pneumatic clamp as applied to drill press. In this shop all the heavy radial presses are equipped with this attachment. The clamp holds the work secure and is very quick to operate. It is made adjustable to suit any height of work. It saves the time of loosening and tightening of nuts, which amounts to something in a month's time.

SWING POLISHING MACHINE.

Fig. 11 is a drawing of swing polishing machine, which is not a new idea, but may be interesting to many readers. This

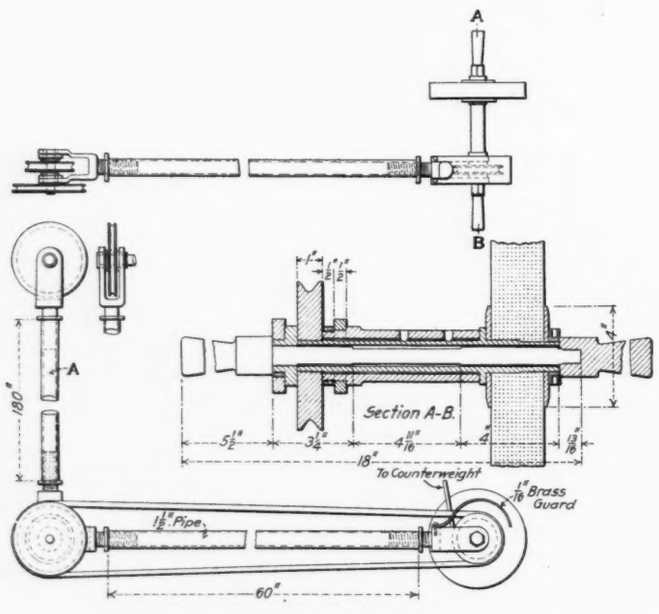


Fig. 11—Polishing Machine. Kellogg.

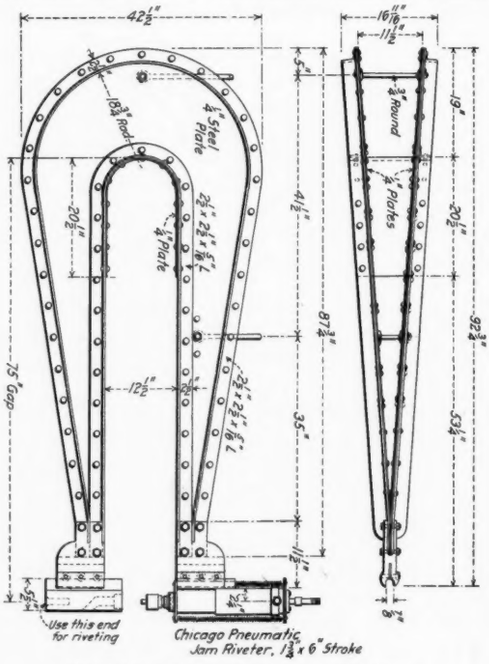


Fig. 12—Yoke Riveter. Kellogg.

machine does all the work of polishing rods, guides, rocker arms, links and motion pins and such other work as may come along for a shop that has an output of from 25 to 30 engines a month.

YOKE RIVETER.

Fig. 12 shows a drawing for a yoke riveter. While a yoke riveter is not a new thing, the way we use this particular machine in the boiler shop is of interest. After the staybolts are all broken down with the staybolt breaker, the firebox is taken out, the backhead, of course, being taken off first. Then we have the broken bolts left in the outside of the sheet. It used to be the custom in this shop to drill or split the bolts with an air hammer, but we found this slow work; hence the reason for the yoke riveter. We apply a Boyer jam riveter by the means shown. We have a portable crane that can be transferred to any part of the shop by means of a large electric crane. This portable crane holds the yoke riveter in any position we want to work in. We take a radial staybolt boiler and knock out every piece of staybolt left in the sheet from the breaker in nine hours, working one man only. The same job used to take one man six days.

WHEEL LATHE DRIVERS.

Fig. 13 illustrates a wheel lathe driver. With a tire lathe the old-style way was to drive wheels with an arm bolted to the face plate, driven from the spokes. While this method is all right in some shops, we think it out of date. Since we designed and made these improved drivers we have been using a set of them for two years. The nice feature about them is that they can be transferred easily to any size tire which is being turned. The driving arm can swing and be locked in the spring clips shown when the wheels are being changed. The grips are made of tool steel, and hardened, and are held in position to the tire by means of a screw clamp, or to the jack, as shown. There are four drivers to a machine, two on each face plate, set about quartering, so when tire is being turned they help steady the driving wheel under heavy duty.

EIGHTH COLLECTION.

BY J. F. PERRITT,
Blacksmith Foreman, Seaboard Air Line, Jacksonville Shops.

TOOL FOR MAKING WEDGE BOLT KEEPERS.

This tool is an attachment for a press of any kind, whether operated by air or power. It consists of a head, A, to which the connections, D, are pinned, and these take hold of the forming pieces, C, at the other end. The forming pieces, C, are, in turn, pivoted to the base, B. When the head is drawn back the forming pieces are in the position shown by the dotted lines. The piece to be shaped is straight, and is placed

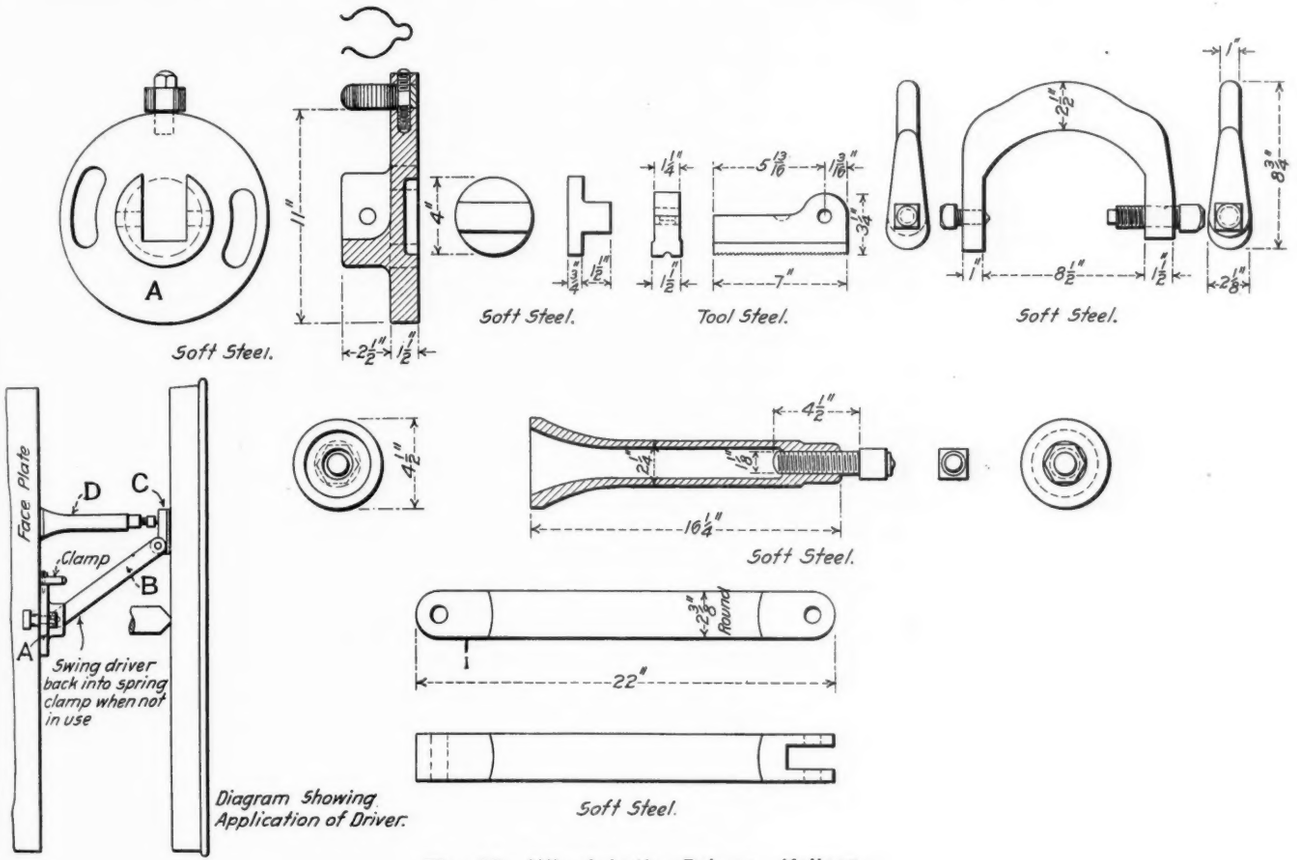


Fig. 13—Wheel Lathe Driver. Kellogg.

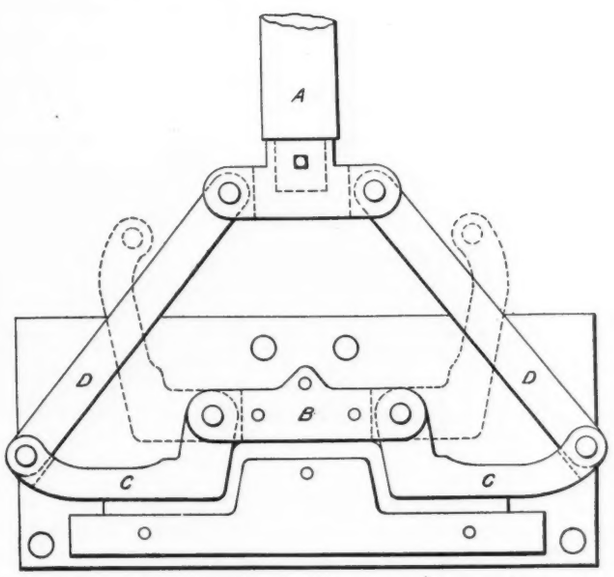


Fig. 14—Tool for Making Wedge Bolt Keepers. Perritt.

between the base, B, and the anvil. Pressure is then applied, and the first move is to clamp the piece solidly between the base, B, and the anvil. Then, as the head moves down, the forming pieces, C, are turned about the pins in the head and come down against the work, and when the stroke has been finished, it has been bent to the shape shown in the engraving. The same device can be used for the carry iron of couplers.

TOOL FOR MAKING SPLIT KEYS.

Fig. 15 shows a stamp and die for use under a steam hammer for making split keys. The die has a hole cut through it, the shape of the keys to be made, and has welded to it a long

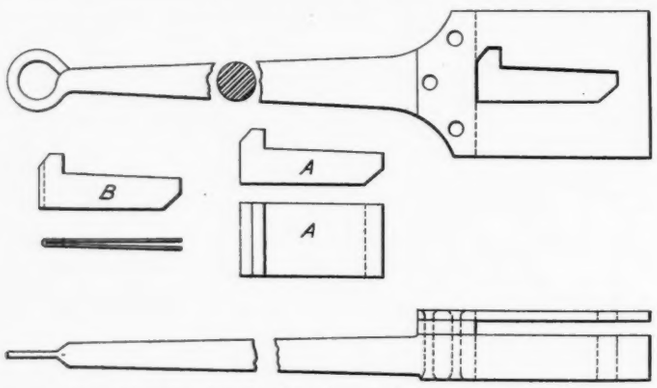


Fig. 15—Device for Making Split Keys. Perritt.

handle for manipulating it. The die punch, A, is made to fit into the die, and by laying the iron to be cut over the hole and driving down with the punch, the key of the shape shown in B is made.

TOOL FOR BENDING EYE-BOLTS.

Fig. 16 shows a tool for bending eye-bolts on a small machine. The head, A, is attached to the head of the machine,

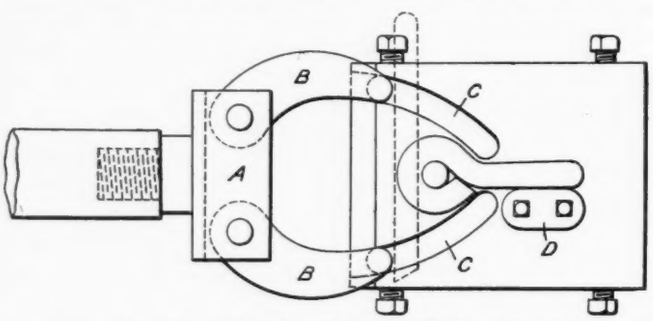


Fig. 16—Tool for Bending Eye-Bolts. Perritt.

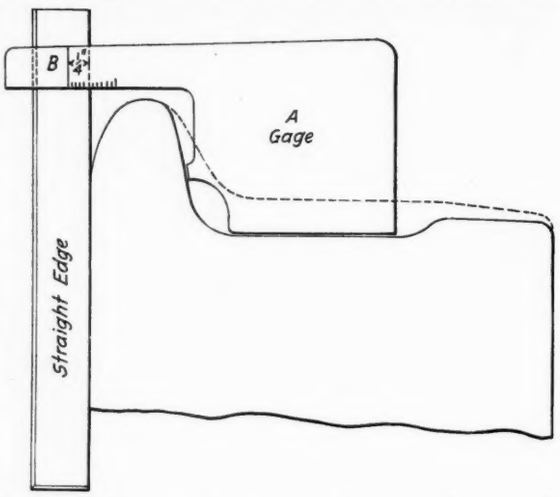
and to it are pivoted the two arms, BB. At the outer ends of these arms there are pins that move in and are guided by the slots in the anvil or former, CC. The round to be bent is laid across the pin, as indicated by the dotted lines, the pin being of the diameter that is desired to have the hole in the eye. The head is then pushed down, and the arms guided by the slots, CC, bend the round bar in front of them until its long end strikes the stop, D. The upper arm then necks it in and the short arm is bent around to form the head of the eye.

NINTH COLLECTION.

BY W. H. SNYDER,
Assistant General Foreman, N. Y., Susq. & Western, Stroudsburg Shops.

TURNING DRIVING-WHEEL TIRES.

The question of turning driving-wheel tires is not looked into as it should be in the majority of the locomotive repair shops. Driving-wheel tires are very expensive, and with improper turning will not last long. When an engine comes in for repairs with badly worn flanges the wheels are put in the lathe and the tires are turned down at random till a good



A. Flange worn.	B. Depth of cut.	C. Reduction of tire in diam.	A. Flange worn.	B. Depth of cut.	C. Reduction of tire in diam.
3/32-in.	1/16-in.	1/8-in.	9/32-in.	1/2-in.	1 in.
1/16-in.	1/8-in.	1/4-in.	5/16-in.	17/32-in.	1 1/16 "
3/32-in.	3/16-in.	3/8-in.	11/32-in.	9/16-in.	1 1/8 "
1/8-in.	1/4-in.	1/2-in.	3/8-in.	19/32-in.	1 1/4 "
5/32-in.	5/16-in.	5/8-in.	13/32-in.	5/8-in.	1 5/16 "
3/16-in.	11/32-in.	11/16-in.	7/16-in.	11/16-in.	1 3/8 "
7/32-in.	3/8-in.	3/4-in.	15/32-in.	3/4-in.	1 1/2 "
1/4-in.	7/16-in.	7/8-in.	1/2-in.	25/32-in.	1 5/8 "

Fig. 17—Gage and Table for Turning Driving Wheel Tires. Snyder.

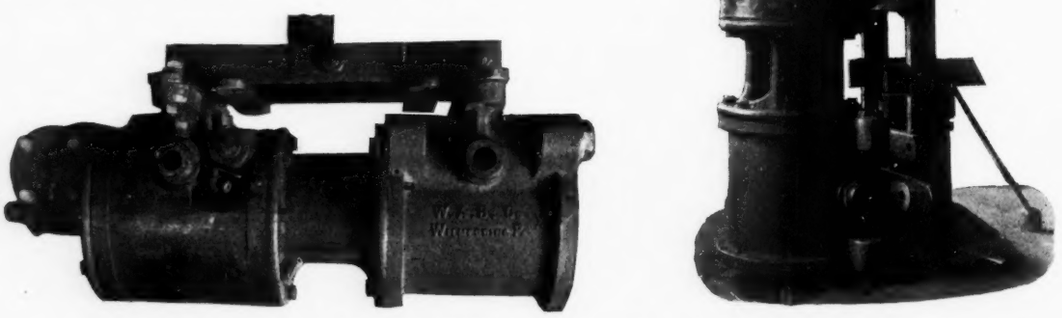


Fig. 18—Device for Handling Air Pumps. Snyder.

flange is obtained. In some cases where the flanges are worn badly and the shop management has no rule to go by, the wheel lathe man will take off a good big cut, thinking he will get a full flange, and when he comes to finish it up he finds

that it will not true up and make a proper flange, so it will be necessary to take another cut, which takes time, or he will take a deep cut and get it too deep, thereby wasting the tire. Herewith is presented a sketch and table which has been gotten up and put in service in the shop at this place with excellent success. Take the smallest tire in the set and the one with the thinnest flange. Make a gage, A, from number 16 or 18 boiler iron; put a line at B for the standard thickness of flange, graduating it back about half-inch; put a straight-edge across the inside of the tire, and by whatever the flange is worn, refer to table (column B) opposite the amount so worn (for instance, ¼ in.), and the depth of cut will be found in the case $\frac{1}{16}$ in. and ⅞ in. reduction in diameter, as per column C. After finding out how much the flange is worn, caliper the smallest diameter of the tire with the worn flange, as referred to above. Then close up the calipers ⅞ in. and the turning can be done on a mechanical system, with no guesswork. This table can be printed on good paper and put into a frame and hung up at the wheel lathe, so it can be referred to at any time. With this system time is saved by knowing how deep to go and tires are saved by not going too deep. This table applies to all steel-tired wheels.

DEVICE FOR HANDLING AIR PUMPS.

This device is a great labor-saver, as one man can very easily handle a pump when it is being repaired. Figs. 18 and 19 show the table in a vertical position, with a pump ready to be bolted to it. The table pivots on a center leg, which is the piston of an air cylinder sunk into the floor. To the right, in Fig. 18, can be seen a diagonal rod, one end of which

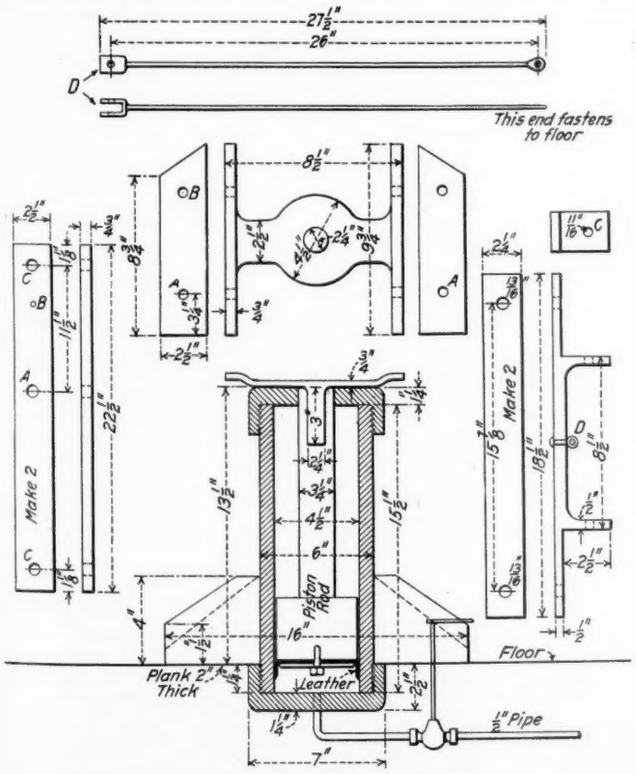


Fig. 19—Device for Handling Air Pumps. Snyder.

is pivoted to the table, while the other end is fastened in an eye-bolt in the floor. When the pump is secured to the table the air is turned on, the piston ascends and the rod at the end of the table draws it to a horizontal position, with the pump in a good position for repairing. When the table is in a horizontal position it is locked by means of a little pin; the rod at the end is removed and the pump and table can be swung around so as to secure the best light for working. This device is very simple. The base is made from an old piston head spider and the cylinder is made from an old second-hand hydraulic jack barrel.

TOOL FOR TURNING THE ENDS OF SHAFTS.

Fig. 20 shows a tool for turning the ends of shafts with arms too long to swing in the lathe. The center, X, is made to fit the spindle. The yoke, A, can be made to suit any tool post, and the end for the tool, E, can be made to take the size steel you have at hand. A key, F, is fastened in the

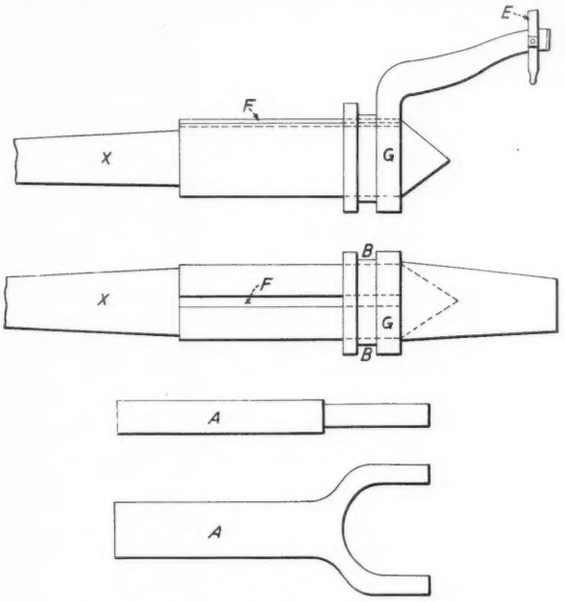


Fig. 20—Tool for Turning the Ends of Shafts. Snyder.

center, as shown, and a key-way is put in the sliding head, G, so it will turn with the center. The head, G, should be a neat sliding fit on the center and key. The yoke, A, should fit the groove, BB, snugly. When the yoke is fastened in the tool post the feed can be put on in the usual way.

BELT-LACING DIAGRAM.

There seems to be no standard method for lacing belts. In most shops every man has his own way, and some belts get improper treatment, especially those running on cone pulleys. The shifting of a cone belt from one cone to another is very important. If the proper care is not exercised a belt can soon be stretched out of shape on one side and will have a tendency to creep on the next cone. In lacing the belt both

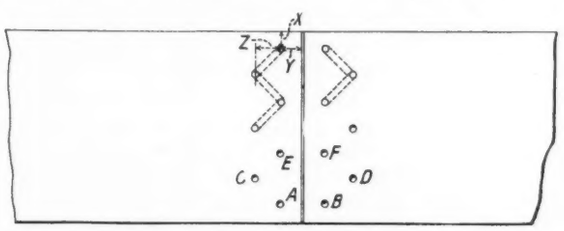


Fig. 21—Diagram for Lacing Belts. Snyder.

Table for Lacing Belts.

Width of Belt.	Lacer.	No. holes in First row.	No. holes in Second row.	Distance of holes At X.	Distance of holes At Y & Z.
2-in.	¼-in.	2	1	½-in.	½-in.
2½-in.	¼-in.	3	2	½-in.	½-in.
3-in.	$\frac{1}{16}$-in.	3	2	½-in.	½-in.
3½-in.	⅜-in.	3	2	½-in.	½-in.
4-in.	⅜-in.	4	3	½-in.	½-in.
4½-in.	$\frac{1}{16}$-in.	4	3	½-in.	½-in.
5-in.	$\frac{1}{16}$-in.	5	4	½-in.	⅝-in.
5½-in.	$\frac{1}{16}$-in.	5	4	½-in.	⅝-in.
6-in.	½-in.	5	4	⅝-in.	¾-in.
6½-in.	½-in.	6	5	⅝-in.	¾-in.
7-in.	½-in.	6	5	⅝-in.	¾-in.
7½-in.	½-in.	7	6	⅝-in.	¾-in.
8-in.	$\frac{1}{16}$-in.	7	6	⅝-in.	¾-in.
8½-in.	$\frac{1}{16}$-in.	7	6	¾-in.	⅞-in.
9-in.	$\frac{1}{16}$-in.	7	6	¾-in.	⅞-in.
9½-in.	$\frac{1}{16}$-in.	8	7	¾-in.	⅞-in.
10-in.	⅝-in.	8	7	¾-in.	1 in.
10½-in.	⅝-in.	8	7	¾-in.	1 in.
11-in.	⅝-in.	8	7	¾-in.	1 "
11½-in.	⅝-in.	9	8	¾-in.	1 "
12-in.	⅝-in.	9	8	¾-in	1 "

ends should be cut square and drawn tight against each other. When shifting a belt from one cone to another care should be taken not to drag it from the smallest to the largest cone, but to get it on the cone next to the one it is to be put on. Then, with very little effort, it can be put where it is wanted and not stretched out of shape. Do not put any resin or any kind of belt dressing that will hang or stick on the side of the cone, as this is very destructive to a belt. As soon as a belt starts to creep on the side of the cone it should be turned end-for-end, or the outside turned to the wheel. Doing this will often save a belt from destruction. For the benefit of the apprentice as to the number of holes and width of laces to be used, we offer a table for lacing belts. This style of lacing is giving us good satisfaction, and the table, which is self-explanatory, may be of use.

Punch the holes as shown on the sketch and table according to the width of the belt. Commence lacing from the outside, bringing one end of the lacer through A and the other end through B, crossing them on the inside of the belt. Put them back down A and B, again coming up through C and D and crossing on the inside as before, and then going back down C and D and coming up through E and F, and so on. In finishing, either tie, or if there is any lacer left, finish by going back, as shown by dotted lines on sketch. When finished, take a hammer and flatten the lacer down. The feature of this lace is that where the lacer crosses on the inside the edges of the lacer are somewhat higher than the rest of the lace, which has a tendency to make it wear longer.

TENTH COLLECTION.

BY F. A. DAILEY,
Northern Pacific Railway, St. Paul Shops.

CALIPERS FOR DRIVING BOXES AND BRASSES.

In fitting locomotive driving brasses into the boxes it is customary to turn off the circumference of the brass in the lathe to the diameter of the box, after which it is put in the shaper and the flanges planed off as close to a fit as possible.

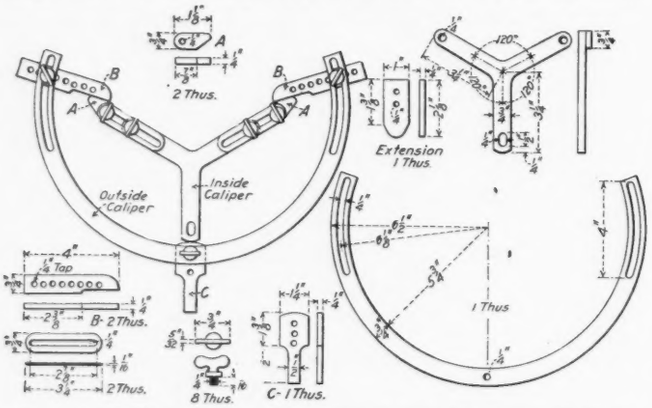


Fig. 22—Caliper for Driving Boxes and Brasses. Dailey.

The job is then finished with a file, and this takes a good while, if the work comes up again and again, in a large shop. The accompanying sketch, Fig. 22, gives a clear idea of a caliper used in a large western railway shop, with excellent results.

The inside caliper is used for getting the inside measurement of the driving-box at its smallest point, which is usually about the center. The outside caliper is then set to the inside caliper, allowing a certain amount for a press fit, depending, of course, upon the size and material in the box and upon the pressure required.

The brass is placed on a slotter and slotted off to the diameter of the box, after which the outside caliper is used to lay off the amount to be taken off the flanges. After being slotted to the caliper, the brass is ready to be pressed into the box, with no filing or fitting. A slotter-hand working on this class of work can fit from ten to fifteen brasses per day.

MANDREL FOR TURNING ECCENTRICS.

Fig. 23 shows the details of a mandrel for turning eccentrics before the key-way is cut.

A face-plate fitted to the lathe doing the eccentrics work is counterbored about ½ in. deep, the size of the outside of casting, A. This casting is fitted and held into the counterbore by the bolt, B. The head of the bolt, B, is slotted and

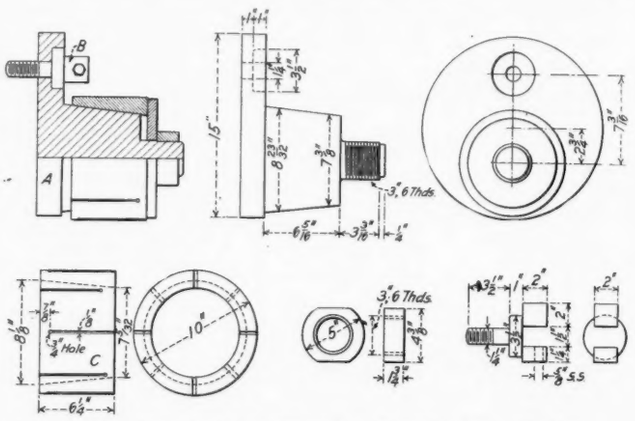


Fig. 23—Mandrel for Turning Eccentrics. Dailey.

projects from the back of casting, A. Two inches into one side of the slotted head is fitted a ⅝-in. set screw.

A lug on the casting, A, is turned to a taper for $6\frac{5}{16}$ in. of its length, and the outer end is threaded and fitted with a nut and washer.

An expanding sleeve, C, the inside bore being the same taper as the lug on casting, B, is pressed part way on the lug, B, and is held in place by the above-mentioned nut and washer.

The eccentric (after being bored) is placed on the mandrel and the rig caught in the slotted bolt and fastened with the set screw. The nut on the end of the lug, B, is drawn tight, thus expanding the sleeve, C, and holding the eccentric rigid.

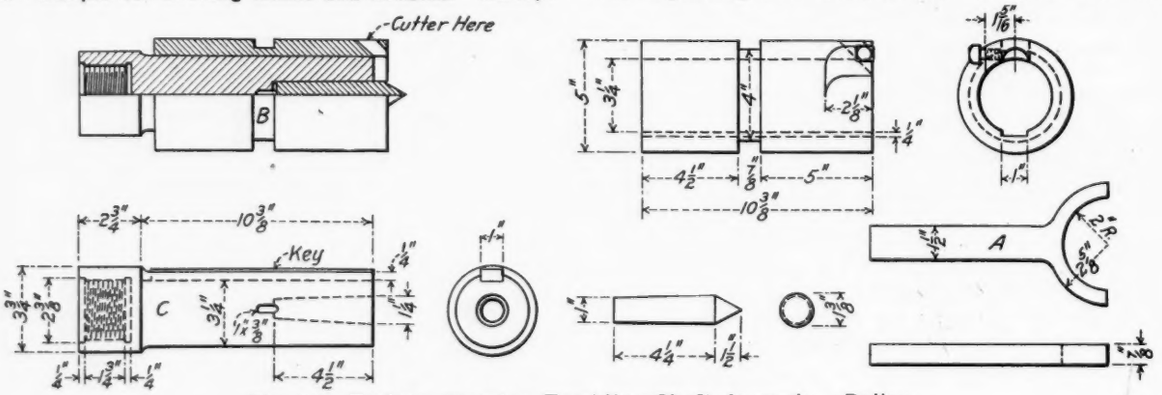


Fig. 24—Tool for Turning Tumbling Shaft Journals. Dailey.

The expanding sleeve will make up for any variations in the eccentric bore.

TOOL FOR TURNING TUMBLING SHAFT JOURNALS.

On account of the long arms on locomotive tumbling shafts it is impossible to swing them in an ordinary engine lathe. Wheel lathes are sometimes used to perform this job, but the journals are usually filed to as near round as possible.

The tool here illustrated is in constant use in one of the Northern Pacific shops, and is giving good satisfaction both in quality of the work and in time.

The stem, C, is screwed to the spindle of the lathe after the face-plate has been removed. The sleeve, B, is a sliding fit on C, but is kept from turning by the key shown.

The center fits into the hole shown in the end of stem, C.

The fork, A, goes in the tool post, the curved end fitting into the groove in sleeve, B.

The tumbling shaft to be turned is placed between the centers and clamped solid. A cutter is put in, as shown in B, and is adjusted to take just enough off the journal to turn it up true. The lathe is then started. The spindle, C, turns the sleeve, B, and the feed screw carries the carriage ahead, thus moving the cutter over the length of the jonrnal.

ELEVENTH COLLECTION.

BY THOMAS MORIARTY,
Pipe Fitter and Coppersmith, Rutland Railroad, Rutland Shops.

REPAIRING BROKEN OIL PIPE IN ENGINE HOUSE WITHOUT BRAZING.

The accompanying drawing shows the connection and tools used for repairing broken oil pipes in the engine house without brazing on the Rutland. The usual procedure in such cases is to apply an outside oil pipe until the engine is placed in the back shop, but this is very unsatisfactory. To obviate this the following method is used:

The first operation is to raise a jacket cut-off from old pipe back of the break and slip the sleeve A over the pipe. Then the split nut B is applied, allowing the pipe to extend $\frac{3}{32}$ beyond end. Then tighten nut C until the sleeve grips the pipe. Then, with tool D bend over the pipe, as shown, releasing the nut B, drawing the sleeve A up to place and connecting the new piece of pipe, E, which has previously been made for stock.

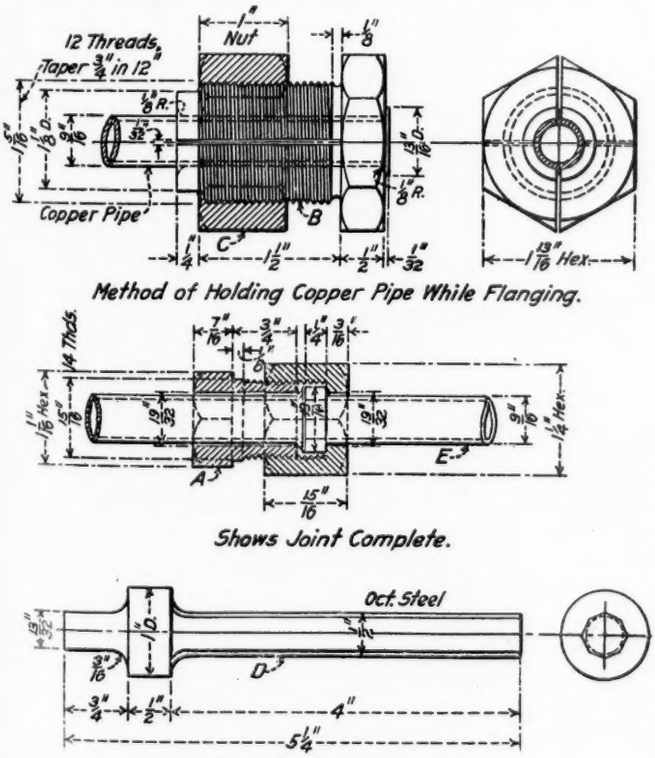


Fig. 28—Connection and Tools for Repairing Broken Oil Pipes in Engine House Without Brazing. Moriarty.

Repairs of this kind have been made complete in 27 minutes

PENNSYLVANIA ELECTRIC LOCOMOTIVES.

The first of the initial order for 24 electric locomotives, which are to be used for handling the Pennsylvania Railroad trains into the New York station, has been delivered and is in operation on the electrified tracks of the Long Island Railroad.

This locomotive incorporates many novel features in electric locomotive design, and is the result of several years co-operative development between the Pennsylvania Railroad Company and the Westinghouse Electric & Manufacturing Company under the supervision of a committee appointed by the railway company composed of George Gibbs, chief engineer of electric traction and station construction, chairman; A. W. Gibbs, general superintendent of motive power, Pennsylvania Railroad; D. F. Crawford, general superintendent of motive power, Pennsylvania Lines West, and Axel S. Vogt, mechanical engineer, Pennsylvania Railroad. It is distinctively a high powered machine, built for high speed operation.

In wheel arrangement, weight distribution, trucks and general character of the running gear it is the practical equivalent of two American type locomotives coupled permanently back to back. The motors are mounted upon the frame and side connected through jack shafts to driving wheels by a system of cranks and parallel connecting rods, similar to steam practice. The connecting rods are all rotating links between rotating elements, and are thus perfectly counterbalanced for all speeds.

The employment of this transmission permits the mounting of the motors upon the frame, secures their spring support, and, in common with the rest of the locomotive, the center of gravity at approximately the same height above the rails, found desirable in the best high speed steam experience.

The same freedom of motion in the wheels and axles that is characteristic of the present steam locomotive is also obviously secured. In these locomotives the variable pressure of the unbalanced piston of the steam locomotive is replaced by the constant torque and constant rotating effort of the drive wheels, and the pull upon the drawbar is thereby constant and uniform. It might to the casual observer appear that by this arrangement of driving a return has been made to steam locomotive practice as regards counterbalancing difficulties, but it will, upon examination, be seen that nothing of the kind is true. There are no questions of unbalanced reciprocating weights involved; all weights are revolving ones and directly counterbalanced, so that, as far as pounding upon the track is concerned, the effect is precisely the same as though the whole were driven without any pins or rods.

The starting requirements of this locomotive are unusually severe; it will be called upon to start a train of 550 tons trailing load upon the tunnel grades under the river which are approximately two per cent. The guaranteed tractive effort of 60,000 lbs. is amply within the capacity of the electrical equipment. The normal speed with load upon a level track is 60 miles an hour, but the locomotive is capable of speed much in excess of this. The total weight of the locomotive is 332,100 lbs., of which 208,000 lbs. is carried by the drivers.

At maximum capacity, this locomotive develops 4,000 h.p. For sustained heavy output, the motors are designed for forced ventilation, but the initial service will not require this provision.

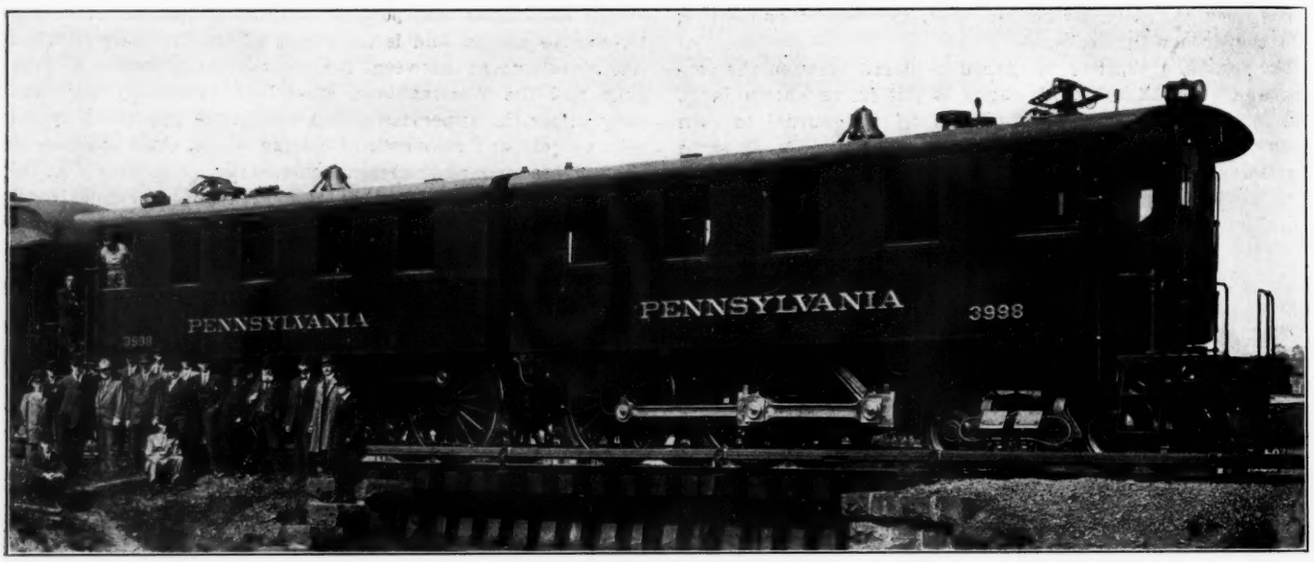
It will be seen that the locomotive is an articulated machine, and that each half carries its own motor and has four driving wheels 68 in. in diameter and one four-wheel swing bolster

swivel truck with 36-in. wheels. Each section has its own cab of sheet steel extending the length of the frame, communication between the two cabs being provided through a standard Pullman vestibule.

The rigid wheel base of each half is 7 ft. 2 in., and the total wheel base of each half is 23 ft. 1 in.; that of the whole locomotive being 55 ft. 11 in. The total length of the locomotive inside of knuckles is 64 ft. 11 in.

The running gear and mechanical parts of this locomotive were built by the Pennsylvania Railroad at the Juniata Shops at Altoona.

The air brake equipment was built by the Westinghouse Air Brake Company, and the electrical equipment was built and the apparatus assembled by the Westinghouse Electric & Manufacturing Company at the East Pittsburgh works.



Pennsylvania Electric Locomotive for Use in the New York Tunnels.

FRAMES.

The locomotive frames are of cast steel of large cross section and massive construction. In their design an unusually large factor of safety has been employed.

The side frames are of sufficient strength to allow the engine to be raised by jacks applied at fixed points provided in the construction with all pedestal binders removed. The upper surfaces of the side frames are especially broad and furnish bases for the feet of the motor frames, which fit over the top members of the side frames with heavy flanges.

There are five heavy cross ties from side of frame to side frame, consisting of bumper, articulation and jackshaft girders, body bolster and drive wheel cross tie. Additional transverse strength is given by the steel motor frame which is bolted to the side frames as elsewhere described.

The bumper and articulation girders are so proportioned that a bump equivalent to a static load of 500,000 lbs. (150,000 lbs. applied on center line of draft cylinder and 350,000 lbs. applied on center line of platform buffer) will produce no stress exceeding 12,000 lbs. per square inch in the frames.

The jackshaft girder is of inverted U section and arranged to give rigid support to the jackshaft bearing brasses. It also carries upon facings the driver brake cylinder, and the brake lever fulcrum are integral with the girder.

The cross tie between driving wheels is of diagonal design, especially fitted for stiffening the bottom members, and also providing a base for the front driver brake hanger pin. This tie fits between the upper and lower members of the side frames and assists in rigidly supporting the heel of the motor frame.

The articulation girder is unusually rigid diagonally in the horizontal plane and is designed to accommodate the articulation gear details.

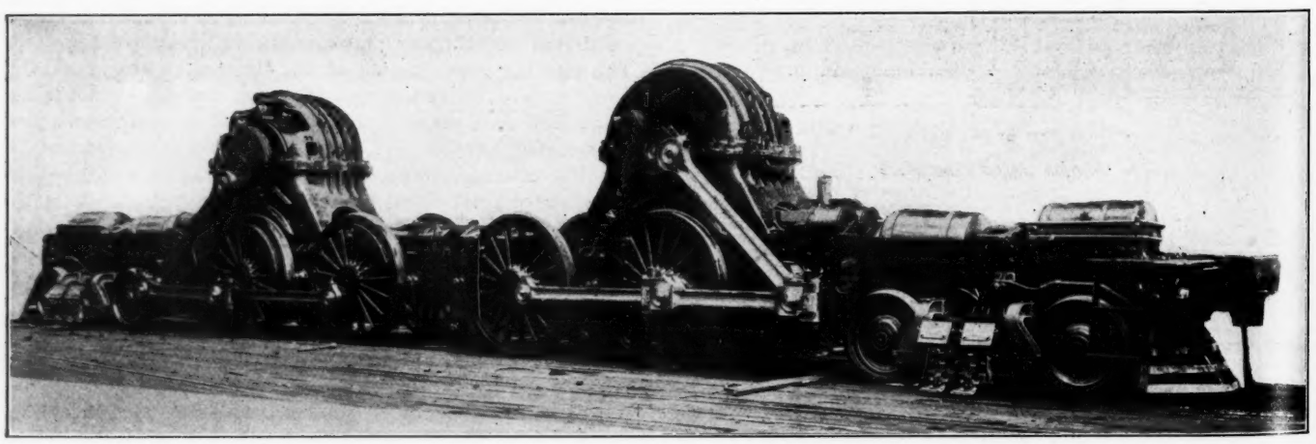
The body bolster carries the swivel truck center pin and is of ample strength to withstand all braking strains.

WHEELS.

The driving wheels are 68 in. in diameter, with tires 3 in. thick, have cast-steel centers and rolled-steel tires, and are fitted with retaining rings.

The truck wheels are of rolled steel 36 in. in diameter.

The driving wheel centers are fitted with quartered crank



Chassis of Pennsylvania Electric Locomotive No. 3998.

pins and counter-balances; these latter are offset from direct opposition to the cranks to correct the transverse unbalance that would otherwise exist.

The axles, jackshafts and motor shafts are of special carbon steel, oil-tempered and annealed. They are of large diameter, finished all over, and each has an axial hole throughout.

CRANKS.

The motor shaft cranks are forged with integral counter-balances, accurately located in quartering positions and press-fitted and keyed to the shaft.

The jackshaft cranks are forged integrally with the shaft in quartering position. Their counter-balances are keyed in position.

As with the driving wheels, the counter-balances of motor shafts and jackshafts are offset from direct opposition to the cranks in order to complete the balance.

All crank pins are of special carbon steel, oil-tempered and annealed, of ample diameter, bored axially and press-fitted to their respective cranks and wheels.

CONNECTING RODS.

All connecting rods are of special carbon steel, oil-tempered and annealed.

Inasmuch as under the action of the brake shoes the wear of the axle and the take-up of the wedges in the pedestal tend to decrease the distance between the axle and the jack-shaft, the main rod is adjustable at each end, so fitted that all take-up shortens the rod and furnishes compensation. The type of adjustable head is that employed on Pennsylvania Railroad Class E-3 locomotives.

All other rods are fitted with solid bushed ends.

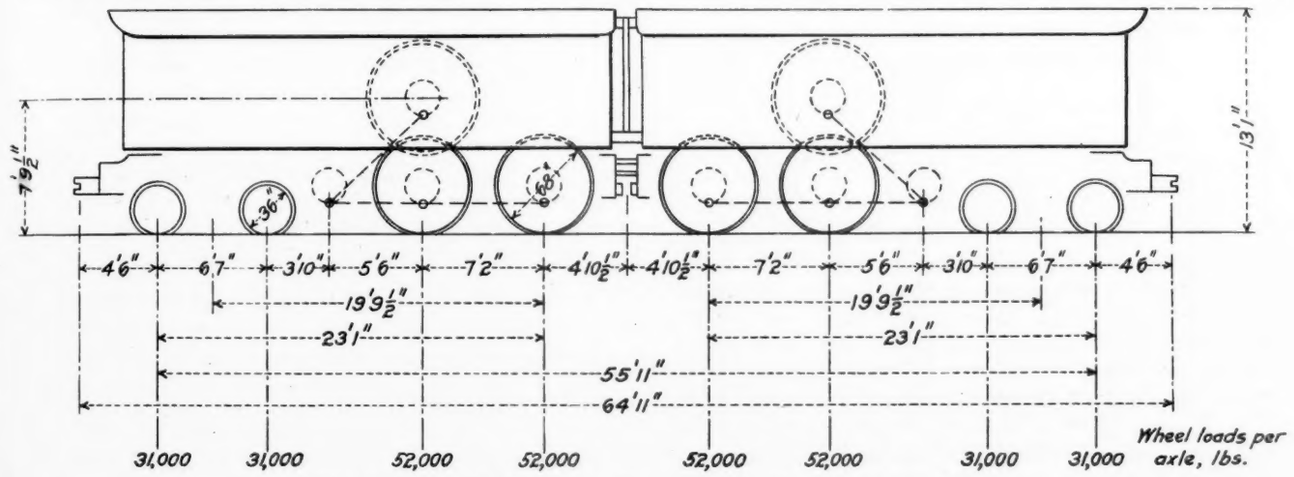
DRAFT GEAR.

The bumper ends of the locomotive are fitted with Westinghouse friction draft gear, standard M. C. B. couplers, and platform buffers of Pennsylvania Railroad standard type.

ARTICULATION DETAILS.

The articulation ends are fitted with permanent couplings of long twin drawbars and Westinghouse friction draft gears so designed that the leading half serves as a leading truck and the other half as a trailer in whichever direction the locomotive may be moving.

The coupling gear is so designed as to oppose any possible nosing tendency or buckling action of the halves.



Distribution of Axle Loads; Pennsylvania Electric Locomotive.

JOURNALS AND BEARINGS.

Main journals are similar to those of Pennsylvania Railroad Class E-3 engines, jackshaft and motor bearings are of ample size, and all are fitted for oil and waste lubrication.

SPRINGS.

Spring rigging of suitable strength, composed of equalizing beams, semi-elliptical springs, links and hangers of usual type, is provided.

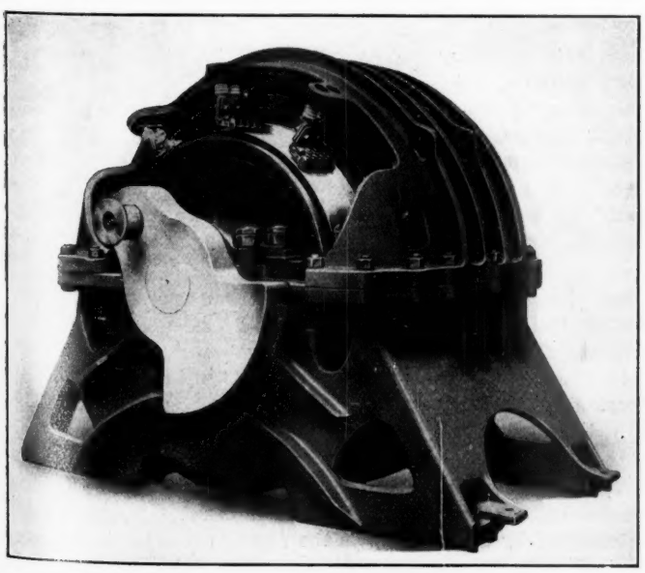
MATERIALS.

All materials of the locomotive running gear were furnished under Pennsylvania Railroad standard specifications with the exception that the axles, shafts, rods and crank pins are of special carbon steel, oil-tempered and annealed, and were subject to special inspection.

CABS.

The cab of each half is an independent structure, complete in itself, so constructed that it may be lifted bodily from the running gear with floor and all auxiliary apparatus and set upon any convenient flat surface or trestle support without damage, leaving the motor and running gear accessible for any desired overhauling and permitting attention to be given at the same time to the machinery in the cab. As earlier stated, the cabs are identical in construction and fittings, and so arraged that they are interchangeable.

The location of the cabs in assembling is determined by dowels fitting in corresponding holes in the running gear. They are held in place by a number of bolts sufficient for security, but the locomotives would have to go beyond their centers of stability before the cabs would leave their seats. The cabs are amply lighted by electric limps. Bulkheads and doors are so arranged that the motor and air compressor compartments, containing nearly all of the auxiliary apparatus, may remain lighted at all times with no intrusion of light in the controller compartment to affect the vision of the driving engineer. Provision is to be made for heating the



Motor Case; Pennsylvania Electric Locomotive.

cabs by steam furnished from electric steam boilers within the cabs.

Each cab is fitted with a bell for hand operation, a chime whistle, sand box and sanders, and also with an overhead collector of pantagraph type, located on the roof, for power supply over gaps of third rail in yards. The sanders and overhead collectors are operated by foot push-buttons located near the master controller within easy reach of the driving engineer.

HEADLIGHTS.

Each cab carries on its own roof, at the end, an electric headlight having for its illuminating element a 50-c.-p. stereopticon lamp operated from the main current, with suitable resistances, on 240 volts. These headlights are not intended to be of high candle power, or to have a searchlight quality, although they might readily have been made so, as the electric current is obviously at hand. It was considered of great importance to avoid the blinding effect on the motorman of a powerful light, as signals with color indication only are provided in tunnels and terminal yard.

AIR BRAKES.

Each half is supplied with complete Westinghouse air-brake equipment actuated by a motor-driven air compressor and 600-volt motor for both automatic and direct braking of locomotive and train. The compressor also furnishes air for the electro-pneumatic switches and its displacement is 65 cu. ft. of free air per minute.

The entire system is especially designed for these locomotives and the foundation brake rigging is suitably proportioned for the weights and arranged for delivery of 85 per cent. braking power at 50 lbs. cylinder pressure.

ELECTRIC EQUIPMENT.

The motive power of this type of locomotive is delivered from two interpole motors on direct current at 600 volts.

The design of these motors was governed by the necessity of commutating the heavy draughts of power required to accelerate the heavy trains on the tunnel grades. For this purpose the design not only affords great electrical stability but renders it possible to use the economical flexible and efficient field control.

Each motor will develop 2,000 h.p. on a current of 2,900 amperes at 600 volts.

The weight of each motor complete without crank is 42,000 lbs.

The motor frames are cast-steel shells divided horizontally and bolted rigidly together. The motor is of open construction, affording easy access to all parts. It is especially provided with powerful self-ventilation. If the full power of the locomotive is to be used more frequently than contemplated, ventilation by air blast can be used to greatly increase the output.

Semi-circular openings in the lower half of the frame provide seats in which the bearing housings are rigidly bolted.

The lower half of the frame is provided with four feet for mounting and bolting on the side frames of the running gear and these feet have machined flanges fitting over the top members on the side frames and stiffening the structure against transverse movement of the part of the motors. In addition to being securely bolted, the feet of the frame are firmly wedged in place.

The motors of these locomotives have ten main poles and ten interpoles, with heavy strap field windings. The main field is split in two halves, both being used together in slow-speed operation. One of these sections is shunted in control.

The armature core is built of soft steel punchings assembled with the commutator.

The commutator bars are of hard drawn copper clamped by cast steel rings over mica insulation.

For relief of the driving mechanism from excessive strains in the event of short-circuit in the powerful motors an adjustable friction clutch of novel design and tested efficiency in action is provided between the armature spider and the motor shaft.

THIRD-RAIL SHOES.

Each half unit is supplied with two pairs of rail shoes of appropriate size and strength, suitably connected and fused. One pair of shoes is mounted on a hard wood beam on each side of the swivel or four-wheeler truck.

CONTROL.

The control of these powerful motors is of Westinghouse shunted field control, and by utilization of the unit-switch system the motors may be grouped in series or in multiple at will.

Electro-pneumatic switches, actuated by air from the brake compressor and operated by magnets controlled from the master controller, are provided to regulate the field strength of the motors by shunting and by cutting out a portion of the field-winding, in addition to the series-parallel grouping, thus giving increased economy of operation and additional running points, greatly improving facility and economy of operation.

The bridging system is used for passing from series to multiple connections.

The motor fields are arranged to be reversed for changing the direction of motion and reversing is accomplished by unit switches.

The master controller is simple in operation and the cab is so arranged that the entire controlling mechanism of the locomotive and train is within reach of the driving engineer.

While it is not intended that the half units be operated independently, the cabs are identically equipped and the windings, connections and control are such that in the event of the disabling of one motor the train may be operated under reduced power by the second motor, the same resistances being employed as for the two.

A master controller with latches handle and suitable operating points is placed in each end of the locomotive and the circuits thereto are so arranged that when two or more locomotives are coupled together all may be operated simultaneously from any one of the master controllers. All switches are operated from the master controller entirely at the will of the motorman or engine driver.

The resistances are of the three-point cash grid type. The grids have such capacity that when one motor is cut out of service the locomotive will operate with the remaining motor.

Under such circumstances the locomotive will exert a tractive effort of 25,000 pounds with the train accelerating at a rate of one-tenth mile per hour per second until the resistance grids are cut out.

Suitable receptacles and jumpers are provided to establish the necessary low voltage control circuits between the locomotive half units and between the adjacent locomotives.

A duplicate set of small storage batteries is supplied in each half unit for operation of the control circuits; and relays with suitable resistances are provided for shunting part of the current of the compressor through the batteries for automatic charging.

An exceptionally quick-acting circuit-breaker is supplied on each half unit and connected between the junction of the third-rail shoe and overhead collector cables and the switch groups. The main switch is on the line of the circuit-breaker.

TEST.

At the first official test of this locomotive, last week, a six-car train was hauled over a six-mile stretch of the Long Island Railroad on the Far Rockaway branch. The outward trip was made at an average speed of 63 miles an hour. The locomotive ran very smoothly, and the test was successful in all particulars.

The Hungarians are about to build a bridge over the Danube, where a ferry has taken cars across heretofore, sometimes interrupted by ice. This is on the route to Hungary's Adriatic port, Fiume. The bridge will have six openings, each of 100 meters.

General News Section.

The Pittsburgh & Lake Erie has raised the pay of track laborers from $1.50 a day to $1.65.

Henry B. Seaman, chief engineer of the New York State Public Service Commission, First district (New York City), has been appointed consulting engineer for the new subway at Cambridge, Mass.

The line of the National Railways of Mexico between Monterey and Matamoros, 204 miles, was opened for business on October 29 after having been blocked since August 28 because of damage done by the great flood of that day.

According to a Bloomington paper, the freight trains of the Chicago & Alton running out of that city are now made lighter than heretofore, with a view to preventing delays. Both north and south from Bloomington the maximum tonnage will be 2,400 tons, which is 200 tons less than heretofore. Smaller engines will be favored in a similar way.

A dinner was given at Chicago on October 27 in honor of Ira G. Rawn, vice-president of the Illinois Central, who on November 1 became president of the Chicago, Indianapolis & Louisville. J. T. Harahan, president of the Illinois Central, was toastmaster, and made a brief talk praising Mr. Rawn's work on the Illinois Central and felicitating him on his promotion. The dinner was attended by most of the higher officers of the Illinois Central.

A Veterans' Association has been formed by those employees of the Pittsburgh & Lake Erie who have been in the service of the company 20 years or more, and on the evening of October 25 these veterans had a banquet in Pittsburgh. Two hundred men and two women were present at the banquet, and 112 other employees are entitled to membership. Colonel J. M. Schoonmaker, vice-president of the road, presided, and had on his right James B. White, laborer, and on his left Thomas Carlin, a gateman. These three, with seven others, have been on the Pittsburgh & Lake Erie since the road began business in 1878.

The Corporation Tax Law.

At the convention of the National Association of Agricultural Implement & Vehicle Manufacturers, held in Chicago last week, representatives who had been appointed to report on the subject recommended that corporations, members of the association, in complying with the federal income tax law do so under protest, this on the ground that there is serious doubt of the constitutionality of the law. At Wilmington, Del., October 28, two lawyers were arrested on the charge of conspiring to commit an offense against the United States, they having advertised their willingness to show corporations how to evade the federal corporation tax law.

Waterways Convention.

The delegates to the convention of the National Waterways Congress at New Orleans, on November 1, adopted resolutions demanding that a definite and vigorous policy of waterway improvement, beginning with the Lakes and the Gulf waterway, be adopted and put in operation by the national government without delay. The language quoted indicates the general tone of all the resolutions adopted. The convention had been told by President Taft, Speaker Cannon and other public men that before waterway development was attempted care should be taken to ascertain the cost and the probable benefits, but the delegates had no taste for this conservative counsel. Assuming, therefore, like the three famous tailors of tradition, that they represented the people of the nation, they proceeded to indicate to the President and Congress that the question of whether a deep waterway should be built was not one to be settled by them, but one to be settled by an entirely unofficial body of persons appointed mainly by commercial organizations; and they served a notice that "to the enforcement of this demand we pledge our individual effort and our united support, and we hereby publicly pledge our personal honor, each for himself and to each other, to support no candidate for public office who will not unqualifiedly endorse and maintain that policy." The resolutions thunder almost as much in the index as they do in the peroration. The following from the preface to the principal resolutions indicates their contents:

"We the delegates to the fourth Lakes to the Gulf deep waterway convention, the largest convention of the people of the United States ever assembled for the purpose of promoting commerce through the development of our waterways, comprising duly appointed delegates to the number of more than 5,000 from every state in the Union, do hereby resolve and declare:

"It is our firm conviction and our fixed intention that the federal government should and shall without needless delay enter upon a definite policy and plan of waterway development, beginning with the improvement of the Mississippi and Illinois rivers as the main trunk of a great waterways system, in such manner as to open effective navigation between the Gulf of Mexico on the south, and the Great Lakes on the north; such main trunk to be developed without disparagement of and with constant reference to the concurrent development of the tributaries, the other great rivers of the country and their tributaries, the lakes, bays, bayous and sounds of all sections of the country, and the canals and connecting passages required in and for a comprehensive system of inland navigation adapted to our great and rapidly growing commercial needs."

The resolutions repudiate and condemn those portions of the report of the board of army engineers which question or deny the commercial expediency and necessity for the construction of a deep waterway.

Beginning of New Subway in Brooklyn.

The Board of Estimate and Apportionment of New York City by unanimous vote has authorized the bond issues necessary to begin work on the Fourth avenue (Brooklyn) subway. This action was taken immediately after the court of appeals had handed down its decision on the subject, which was held in abeyance over a doubt about exceeding the debt limit. While the subway project involves $15,886,381 for the construction work, the state public service commission, which approved the contracts for the first six sections on June 5, 1908, had asked for only $2,850,000 for the present time, for the reason that the commission's engineers believed that not more than that amount could be expended in one year. Under the decision of the court of appeals, however, the entire amount becomes a city liability as soon as the contract is confirmed by the Board of Estimate.

The resolution passed calls for the sale of corporate stock to the amount of $2,850,000 needed to go ahead with the work. The contract prices of the lowest bidders for the six sections of the subway, extending from the Manhattan bridge entrance to Forty-third street and Fourth avenue, Brooklyn, were as follows:

No. 1.—Manhattan Bridge connection No. 1, Flatbush avenue extension, from Nassau street to Willoughby street. J. G. Graham, contractor	$1,020,476
No. 2.—Section 9-C-1—under Flatbush avenue extension and Fulton street, from Willoughby street to Ashland place. William Bradley, contractor	3,436,019
No. 3.—Sections 11-E-1 and 11-A-1—under Ashland place and Fourth avenue, from Fulton street to Sackett street. William Bradley, contractor	3,392,091
No. 4.—Section 11-A-2—under Fourth avenue, from Sackett street to 10th street. E. E. Smith Contracting Co., contractors	2,283,553
No. 5.—Section 11-A-3—under Fourth avenue, from 10th street to 27th street. Tidewater Building Co. and Thomas B. Bryson, contractors	1,945,640
No. 6.—Section 11-A-1—under Fourth avenue from 27th street to 41st street. E. E. Smith Contracting Co., contractors	2,808,982
Total	$14,886,763

In addition to this the pipe galleries will cost $999,617, bringing the total cost of construction up to $15,886,381.

Illinois Central to Burn Coke.

J. T. Harahan, president of the Illinois Central, has announced that this road expects within 30 days to equip the locomotives running to and from the Chicago terminals for burning coke. The company had intended to delay this change until it could build coke-ovens at its Burnside shops, but it has now decided to buy enough coke for present use. Mr. Harahan said that while the road ought to be able in time to make from western coal all the coke that it needs and at a reasonable figure, it will take some time for it to complete its experiments. It will take from 600 to 800 tons of coke a day to supply the locomotives used on the terminals.

A Rail-and-Water Pullman Car Line.

In connection with the presidential river parade from St. Louis to New Orleans, the Louisiana Railway & Navigation Company, whose line extends from Shreveport southeast to New Orleans and which is parallel to the Mississippi river from Angola southward, ran a rail-and-water sleeping-car line. A special train of Pullman cars was scheduled to start from Shreveport at 1 a. m. on Friday, October 29; stop at Alexandria for breakfast and reach Naples at 11:30 a. m., where the cars were to be transferred to a steel barge and complete their trip to New Orleans on the river.

The Russian Railway Situation.

The Russian government, unable to make both ends meet without the help of foreign gold, is considering the advisability of turning over a new leaf. This new leaf, however, looks uncommonly like an old one, for it also contains conditions under which foreign capitalists would be willing to credit the Tsar's government with a large sum of money. The only essential differences are that this time guarantees, tangible, productive guarantees, are demanded, and the capitalists who expect to receive them are British subjects. The leading facts are these.

The finance minister has undertaken not to negotiate any further loans before 1911. On the other hand, the Russian government cannot do without a fresh inflow of foreign gold during these 15 months. The only issue out of the difficulty would be some such circuitous operation as was carried on until lately by guaranteeing railways to be built.

At present a different type of operation has been proposed to the Russian government by English capitalists. They demand a concession to exploit the northern railways, and also the mineral wealth of North Russia for a considerable number of years, in return for which they are understood to have offered $125,000,000. This syndicate is said to have been formed by an English bank.

It is believed that the syndicate asks that the St. Petersburg-Vologda-Vyatza line, the Perm-Kotlas line and the Moscow-Archangel railway shall be handed over to it for a long term of years, together with the sole rights of exploiting the mineral wealth and the forests. The syndicate would provide funds for the service of the priority loans which the government issued when those railways were being built.

In Russian commercial circles, as usual, dissatisfaction is manifested that foreigners should be allowed to thrive at the expense of Russians, and it is asserted that the forests alone bring in $25,000,000 yearly, and if properly looked after would be worth $42,500,000.

It is alleged that the syndicate stipulated that the rails and wagons imported into Russia for the undertaking should be duty free, but the government has declined to entertain this demand.

Hitherto the Russian railways, whether managed by the state or private companies, have been worked at a loss. The state railways have lost steadily and increasingly. The deficit was 20,000,000 roubles* in 1903, 32,500,000 roubles in 1904, 89,500,000 roubles in 1905, 113,500,000 roubles in 1906, and 120,000,000 roubles in 1907. A curious detail is that the greater the general receipts from the railways the heavier is the loss to the state. On every fresh rouble the government receives it incurs a loss of a rouble and 21 copecks.—*London Daily Telegraph.*

*The value of a rouble is about 50 cents.

American Association of Railroad Superintendents.

The Central Association of Railroad Officers at its twenty-second annual meeting, held at Cincinnati, on September 22 and 23, changed its name to the American Association of Railroad Superintendents. O. G. Fetter, secretary-treasurer, has issued a circular giving the following information:

The object of the organization is to be "the development and solution of problems connected with railway operation, but more particularly co-operation and unanimity of action in such matters at junction and terminal points common to its members." It is also provided that "matters of large importance, involving action beyond the authority of its members, shall be referred to the American Railway Association with the recommendation of this association."

Two standing committees are provided for; one to be known as the transportation committee, whose duty it will be to "report upon questions affecting transportation, such as train rules, yard service, freight house service, etc.," and the other as the interchange car inspection committee, "to report on all matters pertaining to interchange car inspection, loading and adjustment of lading, icing, etc."

The membership, as the name indicates, will consist of superintendents or officers performing the duties of the superintendent where a road has no officer with that title; but, "any official of a railway whose superintendent is a member will be admitted to the sessions and may join in the discussions or serve on the committees of the association."

The organization now has divisions at the following points: Cincinnati, Ohio; Indianapolis, Ind.; Columbus, Ohio; Toledo, Ohio; Peoria, Ill.; St. Louis, Mo.; Kansas City, Mo.; Louisville, Ky.; Detroit, Mich.; Denver, Colo.; Omaha, Neb.; Memphis, Tenn. Memphis was admitted to divisional membership at the last meeting.

Two regular meetings a year are provided for, falling on the third Friday of March and of September, and the first meeting under the new by-laws will be held at Chicago.

The officers elected for the ensuing year are: President, J. A. Somerville (M. P.), Kansas City, Mo.; first vice-president, Brent Arnold (L. & N.), Cincinnati, Ohio; second vice-president, S. M. Russell (T. P. &. W)., Peoria, Ill.; secretary-treasurer, O. G. Fetter, Cincinnati.

Central Railway Club.

The next regular meeting will be held at the Hotel Iroquois, Buffalo, N. Y., November 12. G. Herbert Condict, secretary of the International Lecture Institute, will present a paper on Terminal Freight Handling by Electrical Machinery, illustrated with lantern slides.

American Society of Civil Engineers.

At the meeting held on November 3 two papers were presented: The Reinforced Concrete Wharf of the United Fruit Company at Bocas del Toro, Panama, by T. Howard Barnes, M. Am. Soc. C. E., and River Protection Work on the Kansas City Southern Railway near Braden, Okla., by J. A. Lahmer, M. Am. Soc. C. E. Mr. Barnes' paper was printed in the September number of *Proceedings*, and Mr. Lahmer's in the October number.

Railway Business Association Dinner.

The speakers at the first annual dinner of the Railway Business Association at the Waldorf-Astoria Hotel, New York, next Wednesday evening, November 10, will be: Hon. John C. Spooner, former United States Senator from Wisconsin; W. C. Brown, president of the New York Central; E. P. Ripley, president of the Atchison, Topeka & Santa Fe; W. H. Marshall, president of the American Locomotive Company, and Hon. W. P. Hepburn, of Iowa. The toasts will be: The Public and the Railroads, Mr. Spooner; The Nation's Farms, Mr. Brown; The Railroads and Public Approval, Mr. Ripley; The Equip-

ment Industries and Railroad Prosperity, Mr. Marshall; Popular Sentiment and Railroad Legislation, Mr. Hepburn.

New York Railroad Club.

The next regular meeting will be held November 19. H. McL. Harding, vice-president of the International Lecture Institute, will present a paper on The Handling of Freight at Terminals, illustrated with lantern slides.

Association of Dining Car Superintendents.

The American Association of Dining Car Superintendents held its annual meeting in Chicago on October 21 and 22. The following officers for the next year were elected: President, W. A. Cooper (C. P.), Montreal, Canada; vice-president, G. H. Baird (Pullman Co.), Chicago; secretary and treasurer, F. M. Dow (I. C.), Chicago. The next meeting will be held at Minneapolis, Minn.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.; May 10-13; Indianapolis.
AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Scranton, Pa. June, 1910; Niagara Falls, Ont.
AMERICAN ASSOC. OF LOCAL FREIGHT AGENTS' ASS'NS.—G. W. Dennison, Penna. Co., Toledo, Ohio.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—R. W. Pope, 33 West 39th St., New York; second Friday in month; New York.
AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Place, New York; Nov. 17; Chicago.
AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—S. F. Patterson, B. & M., Concord, N. H.
AMERICAN RAILWAY ENGINEERING AND MAINT. OF WAY ASSOC.—E. H. Fritch, Monadnock Bldg., Chicago, March 14-17, 1910; Chicago.
AMERICAN RAILWAY INDUSTRIAL ASSOCIATION.—G. L. Stewart, St. L. S. W. Ry., St. Louis; second Tuesday, May; Memphis, Tenn.
AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony Building, Chicago.
AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. Edgar Marburg, Univ. of Pa., Philadelphia.
AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., N. Y.; 1st and 3d Wed., except July and August; New York.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., N. Y.; 2d Tues. in month; annual, Dec. 7-10; New York.
AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.—B. V. Swenson, 29 W. 39th St., New York.
ASSOCIATION OF AM. RY. ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago; June 29, 1910; Colorado Springs.
ASSOCIATION OF RAILWAY CLAIM AGENTS.—E. H. Hemus, A., T. & S. F. Topeka, Kan.; May; Nashville, Tenn.
ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, Wisconsin Central Ry., Chicago. May 16-20, 1910; Los Angeles.
ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Place, N. Y. Dec. 14-15; Chattanooga.
CANADIAN RAILWAY CLUB. James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tues. in month, except June, July and Aug.; Montreal.
CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, Montreal, Que.; irregular, usually weekly; Montreal.
CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo.
FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Rich., Fred. & Pot. R. R. Richmond, Va. June 15, 1910, California.
INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.
INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago; May; Chicago.
INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn.; May; Cincinnati.
IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August; Des Moines.
MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago.
NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tues. in month, ex. June, July, Aug. and Sept.; Boston.
NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August; New York.
NORTH-WEST RAILWAY CLUB.—T. W. Flanagan, Soo Line, Minn.; 1st Tues. after 2d Mon., ex. June, July, August; St. Paul and Minn.
RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, Pittsburgh, Pa.; 4th Friday in month, except June, July and August; Pittsburgh.
RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.
RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio; May 16-18; St. Louis.
ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.
ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis.
SOCIETY OF RAILWAY FINANCIAL OFFICERS.—C. Norquist, Chicago.
SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—J. H. O'Donnell, Bogalusa, La.
SOUTHERN AND SOUTHWESTERN RY. CLUB.—A. J. Merrill, Prudential Bldg., Atlanta; 3d Thurs., Jan., April, Aug. and Nov.; Atlanta.
TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R. R. R., East Buffalo, N. Y.
WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, 199 Chestnut St., Winnipeg; 2d Mon., ex. June, July and Aug.; Winnipeg.
WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony Bldg., Chicago; 3d Tuesday each month, except June, July and August; Chicago.
WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, Monadnock Bldg., Chicago; 1st Wednesday, except July and August; Chicago.

Traffic News.

The New York Central's new train, to run between New York and St. Louis in 24 hours, will have a sleeper to and from Boston. Westbound the train will leave Boston at 11.30 a.m.

A train of the Chicago, Milwaukee & Puget Sound left Tacoma October 31 with $390,000 worth of silk for New York, expecting to beat a Northern Pacific train which left Seattle twenty-one hours earlier with silk worth $360,000.

The Trunk lines announce that freight rates on sugar will be reduced from New York and Philadelphia to Cleveland and other western cities to meet the reductions which have been announced by the lines from New Orleans northward, and which go into effect November 27. The eastern roads will put their new tariff into effect December 4.

A special examiner for the Interstate Commerce Commission took testimony at Cincinnati, Ohio, on October 30, on a complaint of the Cincinnati & Columbus Traction Company, an electric road, against the Baltimore & Ohio, the Norfolk & Western and the Cincinnati, Lebanon & Northern for alleged refusal to enter into arrangements for the interchange of passenger and freight traffic with the electric road.

The Washington Southern has petitioned the Virginia State Corporation Commission for authority to raise its maximum passenger rate from 2 cents a mile to 3 cents. During the past year, under the 2-cent law, the passenger business of the road has fallen short of paying its share of the expenses and fixed charges by about $25,000. It appears that, to take advantage of the low intrastate fares which, by the law of Virginia, the road has been obliged to adopt, large numbers of passengers buy their tickets to and from Alexandria, which is at the northeastern border of the state, and between there and Washington travel by the electric line or buy a separate interstate ticket, or pay cash fare. This has made the volume of sales of intrastate tickets to and from Alexandria show an abnormal increase. During the last fiscal year more than 90 per cent. of the passenger earnings from intrastate passengers was reported from Alexandria, that station selling five or six times as many tickets as formerly.

Controversy Over Freight Rates.

The National Industrial Traffic League has issued a circular giving correspondence regarding the rumored advance in freight rates between the president of the league, J. C. Lincoln, and W. C. Brown, president of the New York Central Lines. Mr. Lincoln stated in his letter that he was receiving communications from all sections asking for information. He said that he was moved to address Mr. Brown, not to start a controversy but to reach an understanding as to what the railways proposed to do. He continued:

"I have felt that with the returning prosperity and the fact that the carriers will be taxed to their utmost capacity, the requiem had been rendered on the proposition to make a general advance in freight rates.

"As President of the New York Central Lines and because of your addresses given throughout the country, you were looked upon as the spokesman for the Eastern lines. An expression from you that there is no movement now in contemplation, nor anticipated in the very near future, for an advance in rates will go far toward building up co-operative relations. We should unite our forces with the end in view of stopping unwise legislation."

Mr. Brown replied October 22 as follows:

"I am in receipt of your favor in regard to an article prepared by Mr. McCain on the "Diminished Purchasing Power of Railway Earnings." While we concur fully with the conclusions reached in that publication and have distributed quite a large number of the pamphlets among shippers and others throughout the country, we did this as a matter of education and for the purpose of disseminating information that we believe to be correct, and not with any idea whatever of using it as an argument for an increase in freight rates now or in the near future.

"As a matter of fact, so far as the roads with which I am

connected are concerned, the question of an increase in freight rates is not being discussed or considered and it is our hope that with returning prosperity and a heavy volume of business, no general advance in freight rates will be found necessary.

"While the statistics used can be verified, the railways by reducing the cost of operation have been able in great measure to offset the effect of these conditions.

"I doubt the possibility of much further reduction in the cost of transportation by such increase in efficiency; and any material change in conditions that will add to the present burdens of the railways—such as an enforced general increase in wages, a continued increase in the cost of material, increased taxation or the like, will be very likely to put the railways in a position where a moderate increase in rates will be absolutely necessary if they are to continue to give reasonable service and earn a moderate return on their cost. * * * I agree with you that the interests of the country will be best served by a cessation of the more or less acrimonious argument of a subject that is not of pressing importance."

Argument in Salt Lake Rate Case.

Commissioners Clements, Prouty, Clark and Lane of the Interstate Commerce Commission heard arguments at Salt Lake City on October 29 in the proceeding of the Salt Lake Traffic Bureau for a reduction in rates from the East to Salt Lake City. C. C. Dey and S. H. Babcock, counsel and commissioner, respectively, for the Salt Lake Traffic Bureau, presented the shippers' case, and C. F. Dillard, commerce counsel of the Harriman Lines, and E. N. Clark, general attorney of the Denver & Rio Grande, spoke for the railways.

Mr. Dey said that the Salt Lake Traffic Bureau challenged the class rates between Chicago, the Mississippi river and the Missouri river territory, on the one hand, and Utah common points on the other, in both directions, as unreasonable compared with the charges assessed for longer hauls between other points; also the commodity rates applying between the same territories, the commodity rates now applied between eastern points and the Pacific coast, the blanket rates on citrus and deciduous fruits and vegetables in carloads between California points and Utah and the passenger rates east and west of Utah. He said the rates were challenged as unreasonable compared with those given to San Francisco and also by reason of alleged excessive revenues which the railways derive from them. Replying to the contention of the railways that the rates to the Pacific coast are relatively unreasonable, he called attention to the fact that the Chicago, Milwaukee & Puget Sound, the Western Pacific and other roads have been built or are being built, which will have to rely almost entirely for their revenue on this business, and questioned if these roads would have been built if the transcontinental business were so unremunerative as represented. He contended that the Commission should fix rates to Salt Lake with reference exclusively to their effect on the Union Pacific, which, he said, was the standard road. The effect on other and less favorably situated roads should not be considered.

Judge Dillard, of the Harriman Lines, said that the complainants asked the Commission to fix a general scheme of rates. He denied that the Commission has power to do this, contending that it can only fix reasonable rates when the rates for which they are substituted have been specifically shown by specific evidence to be unreasonable. He said that if water competition did not control the fixing of railway rates to the coast the rates at present in force to Utah points could be regarded as too high in comparison to rates to the coast, but water competition exists and therefore rates to Salt Lake City cannot be shown to be excessive by mere comparison with those to the coast. Commissioner Clark interrupted to ask whether, if the coast rates were not controlled by water competition, it would be within the legal power of the Commission to fix rates to Utah with respect to the coast rates. Mr. Dillard replied in the affirmative. Mr. Clark then asked whether, if the rates to Utah were 50 per cent. higher than now, it would still be unlawful, while water competition to the coast continued, for the Commission to fix rates to and from Utah with respect to rates to the coast. Mr. Dillard replied in the affirmative. He argued that the production of transportation is an instance of joint cost, that transportation to the coast occupies the position of a surplus which the railways must sell for what they can get, however little, or not at all, and that because they prefer to sell it for a small rate rather than get no revenue out of it does not justify anyone in taking their coast rates as a measure of the reasonableness of their rates to interior points.

Mr. Clark, of the Denver & Rio Grande, stated that his road has practically abandoned transcontinental traffic because of its unremunerativeness, and argued that it should not be forced practically to abandon its traffic to Utah, as it would have to do if the rates proposed were put into effect. This, he said, would leave it only the business of its mining communities. He denied that it is getting a large and growing revenue from its business and gave figures to show that for several years there has been a deficit from operation after paying dividends, this deficit being made up from other sources.

S. H. Babcock quoted G. W. Luce, general passenger agent of the Southern Pacific, as having testified that 97 per cent. of its traffic moving through Ogden is transcontinental business. As the road is making large profits as a whole, he said, it must derive a large portion of them from transcontinental business. This being true the rates to Salt Lake City, he contended, could be materially reduced without seriously affecting the revenues of the roads.

Free Advertising for Colorado.

A statement has been issued on behalf of the railways regarding the convention which Governor Shafroth, of Colorado, has called to secure a round trip rate of $25 for tourists from Chicago to Colorado next season. The position of the railways is that $30 for a round trip from Chicago to Colorado points is the lowest rate that can reasonably be made with a guarantee of good service. A $25 rate would not bring a single additional tourist to Colorado, for those who will pay $25 will pay $30. The extra $5 enables the railways adequately to advertise the resorts of Colorado. It is stated that about 110,000 tourists took advantage of the $30 rate to Colorado last summer, paying to the railways an aggregate of $3,300,000 in fares. Of this, $325,000, or about 10 per cent., was spent in advertising Colorado alone. The five roads running into the state spent 50 cents a head for every man, woman and child in it to advertise its resources and attractions. It is estimated that each tourist spends an average of $100 in the state. On this basis about three times as much was spent within the state as for round trip tickets. It is estimated that of those who visited that state at least 60,000 came by reason of the advertising given to it by the railways. It is stated that should a fight for a cheaper rate be pushed to the extreme the railways would naturally feel that the people of Colorado do not appreciate what has been done for them and the roads might withdraw some of the favors now enjoyed.

Standard Forms of Interline Tickets on Western Lines.

The Western Passenger Association lines have adopted the standard forms of interline tickets which were recommended by the committee on this subject in its report to the American Association of General Passenger and Ticket Agents at the meeting of the latter association on September 13. By this change the length of the contracts in all contract tickets is reduced more than one-half, which will be a convenience to passengers.

Among the features of the arrangements of the standard forms are the following: (1) All matter reads from left to right, figures as well as reading matter; (2) the transit limit column is placed in the left-hand margin of the ticket; (3) the final limit column is placed in the right-hand margin; (4) a separate caption is given to each paragraph; (5) the paragraphs are arranged in the following order: (a) going trip; (b) return trip; (c) stopover; (d) validation; (e) identification; (f) non-transferability; (g) baggage; (h) alterations; (i) responsibility.

In all there are 18 forms. Joseph Richardson, chairman of the Southwestern Passenger Association, is chairman of the committee which recommended the standard forms adopted.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF SEPTEMBER, 1909.

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenues (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
		Freight.	Passenger.	Total, inc. misc.	Maintenance Way and structures.	Maintenance Of equipment.	Traffic.	Transportation.	General.	Total.					
Atchison, Topeka & Santa Fe	7,459	$4,842,372	$1,770,049	$7,175,175	$1,098,060	$1,121,807	$134,794	$1,838,686	$187,972	$4,381,319	$2,793,856	.....	$266,579	$2,527,277	$2,680,044
Atlantic Coast Line	4,477*	1,581,794	458,255	2,173,130	315,300	359,803	39,563	650,241	62,749	1,427,656	745,474	.....	95,500	649,974	166,084
Bangor & Aroostook	514	170,356	68,455	249,331	37,598	31,155	3,214	67,987	10,364	150,318	99,013	.....	1,500	97,513	—13,785
Bessemer & Lake Erie	201	854,489	39,841	901,651	66,522	113,370	8,358	186,965	6,683	381,898	519,753	.....	5,000	514,753	189,240
Buffalo & Susquehanna	361	207,486	23,230	236,879	39,575	53,333	2,245	76,957	8,145	180,255	56,624	—$74	4,000	52,550	12,066
Buffalo, Rochester & Pittsburgh	568	673,933	95,458	819,519	112,566	155,391	9,324	203,568	12,718	493,567	325,952	359	13,000	313,311	167,096
Central of Georgia	1,916	732,824	237,267	1,064,952	138,020	145,250	31,087	294,117	43,769	652,243	412,709	5,801	47,400	371,110	58,656
Central of New Jersey	668	1,362,047	418,490	1,890,522	197,648	322,728	28,531	504,973	42,891	1,096,771	793,751	43,314	91,431	745,634	—15,867
Chicago & Erie	269	336,928	74,285	442,831	65,514	86,125	17,030	171,781	9,393	349,843	92,988	.....	10,938	82,050	21,851
Chicago & North Western	7,638	4,869,544	1,883,618	7,237,347	1,223,933	774,766	120,823	2,354,197	95,693	4,569,412	2,667,955	2	228,000	2,439,937	—116,149
Chicago, Burlington & Quincy	9,021	4,934,387	2,261,303	7,806,736	1,651,009	1,295,514	142,194	2,199,186	178,190	5,466,093	2,340,643	—11,399	215,571	2,113,673	—501,608
Chicago, St. Paul, Minn. & Omaha	1,739	877,897	464,993	1,423,223	207,386	156,279	23,523	468,983	25,983	882,154	541,069	1,648	53,008	489,709	51,531
Colorado & Southern	1,250	578,124	185,363	804,183	115,303	122,361	13,911	240,388	21,566	513,529	290,654	725	21,625	269,754	34,590
Duluth, Missabe & Northern	289	1,817,196	35,163	1,860,665	106,915	114,405	1,539	206,467	10,553	439,879	1,420,786	8,048	74,870	1,353,964	293,552
Elgin, Joliet and Eastern	770†	741,899	18	798,210	66,137	148,658	4,078	209,979	12,189	441,041	357,169	.....	13,500	343,669	161,238
Erie	1,961‡	3,023,052	825,431	4,131,233	596,240	692,435	91,286	1,237,715	90,972	2,708,648	1,422,585	—33,766	108,930	1,279,889	168,538
Florida East Coast	584	82,277	52,656	155,434	31,912	30,837	2,701	73,565	6,854	145,869	9,565	.....	11,544	—1,979	47,653
Fort Worth & Denver City	454	278,285	160,252	459,293	56,033	57,389	6,365	128,628	13,459	261,874	197,419	82	9,300	188,201	33,361
Grand Rapids & Indiana	591	231,010	206,344	462,344	53,444	69,157	10,479	164,439	13,302	310,822	151,522	1,672	21,133	132,062	—16,046
Gulf, Colorado & Santa Fe	1,518	751,758	243,799	1,060,213	195,917	163,556	21,684	344,494	30,185	755,836	304,377	.....	32,649	271,728	—66,136
Hocking Valley	350	621,736	90,664	732,774	106,321	130,646	7,392	169,443	12,013	425,815	306,959	16,564	22,328	301,195	43,144
Kansas City Southern	827	525,470	119,704	724,105	85,886	101,269	25,197	237,675	28,133	478,160	245,945	.....	25,831	220,114	2,702
Lehigh Valley	1,441	2,328,185	448,540	2,887,555	346,415	492,351	82,670	825,715	54,642	1,801,793	1,085,762	15,611	94,600	1,006,773	—32,413
Louisville & Nashville	4,398	3,057,763	935,961	4,238,299	452,080	688,054	82,766	1,202,456	83,301	2,508,657	1,729,642	—7,654	124,610	1,597,378	249,280
Maine Central	932	450,807	330,905	828,413	141,309	97,654	7,826	253,430	19,822	520,041	308,372	2,911	31,962	279,321	38,901
New York, Chicago & St. Louis	558	661,715	148,465	844,016	76,678	108,713	48,790	296,051	12,975	543,207	300,809	—353	33,000	267,456	48,749
New York, New Haven & Hartford	2,041	2,471,600	2,435,110	5,354,172	610,482	532,116	30,904	1,860,866	130,052	3,164,420	2,189,752	135,305	320,000	2,005,057	489,637
Norfolk & Southern	582	135,538	58,525	209,774	24,759	32,204	3,889	62,264	13,519	136,635	73,139	1,823	9,900	69,062	17,370
Norfolk & Western	1,941	2,540,884	398,959	3,033,344	294,169	505,246	46,997	811,466	59,343	1,717,221	1,316,123	—809	84,000	1,231,314	305,719
Northern Pacific	5,657	4,691,467	2,499,663	7,589,339	1,084,106	761,313	81,597	2,033,273	89,021	4,049,310	3,540,029	90,336	288,395	3,341,970	17,353
Pennsylvania Company	1,416	3,885,895	758,440	4,962,547	583,139	707,270	70,685	1,323,919	70,318	2,755,331	2,207,216	—2,280	141,400	2,063,536	597,590
Pittsburgh, Cincinnati, C. & St. L.	1,468	2,331,120	779,950	3,446,647	451,070	569,217	68,429	1,006,212	56,594	2,151,522	1,295,125	—900	110,670	1,183,555	267,632
San Antonio & Aransas Pass	727	323,288	87,685	427,638	45,054	44,745	4,103	128,300	9,516	231,718	195,920	.....	9,000	186,920	30,390
Texas & Pacific	1,884	932,668	318,469	1,318,744	150,082	214,624	18,797	446,299	32,374	862,176	456,568	—4,755	38,000	413,813	86,071
Wheeling & Lake Erie	458§	536,999	59,996	645,312	57,062	156,649	6,772	199,366	17,115	436,964	208,348	9,754	23,453	194,649	79,670
Vandalia	827	558,130	224,303	863,432	114,204	142,279	22,894	286,364	18,311	584,052	279,380	.....	24,086	255,294	52,955
THREE MONTHS OF FISCAL YEAR 1910.															
Atchison, Topeka & Santa Fe	7,459	14,138,197	5,347,245	21,029,182	3,235,663	3,030,149	391,156	5,479,221	453,922	12,590,111	8,439,071	.....	745,274	7,693,797	1,293,276
Atlantic Coast Line	4,477*	4,015,422	1,415,935	5,830,732	942,395	1,036,628	110,248	1,961,454	175,794	4,226,519	1,604,213	.....	281,000	1,323,213	299,267
Bangor & Aroostook	514	462,454	192,566	694,467	108,523	84,549	8,636	186,905	29,519	418,132	276,335	.....	4,500	271,835	59,893
Bessemer & Lake Erie	201	2,539,271	123,823	2,685,271	197,980	341,044	22,672	549,052	19,936	1,130,684	1,554,587	.....	15,000	1,539,587	489,858
Buffalo & Susquehanna	361	569,060	75,210	663,673	116,169	153,148	5,973	218,489	23,042	516,821	146,852	9	12.000	134,861	26,892
Buffalo, Rochester & Pittsburgh	568	1,981,354	306,744	2,431,313	304,952	469,105	27,202	597,236	37,544	1,436,039	995,273	420	39,000	956,693	479,352
Central of Georgia	1,916	1,791,770	788,385	2,805,635	425,200	457,245	90,656	831,719	115,979	1,920,799	884,836	20,196	135,800	769,232	87,023
Central of New Jersey	668	3,860,048	1,344,887	5,507,410	554,497	951,633	83,831	1,478,809	130,303	3,199,073	2,308,337	201,513	264,483	2,245,367	169,421
Chicago & Erie	269	879,594	223,444	1,200,609	179,741	265,956	46,052	476,659	26,248	994,656	205,953	.....	32,815	173,138	48,235
Chicago & North Western	7,638	12,804,406	5,443,400	19,738,374	3,453,156	2,220,337	350,268	6,521,908	283,772	12,829,441	6,908,933	4,184	684,000	6,229,117	44,729
Chicago, Burlington & Quincy	9,021	14,115,510	6,639,564	22,533,347	4,675,181	3,623,411	424,349	6,259,911	525,984	15,508,836	7,024,511	—28,285	646,712	6,349,514	—355,976
Chicago, St. Paul, Minn. & Omaha	1,739	2,271,323	1,261,613	3,767,216	648,300	442,130	69,881	1,257,797	81,196	2,499,304	1,267,912	4,328	159,023	1,113,217	93,190
Colorado & Southern	1,250	1,613,070	564,587	2,295,425	350,903	387,141	45,395	685,794	62,180	1,531,413	764,012	3,278	64,875	702,416	26,385
Duluth, Missabe & Northern	289	5,658,181	109,858	5,793,586	324,781	329,822	4,745	623,972	31,087	1,314,407	4,479,179	23,643	236,336	4,266,487	994,308
Elgin, Joliet and Eastern	770†	2,206,914	99	2,366,058	186,804	404,823	12,070	597,995	38,334	1,240,026	1,126,032	.....	40,500	1,085,532	518,503
Erie	1,961‡	8,179,593	2,603,105	11,623,098	1,609,099	2,076,844	271,889	3,539,421	238,576	7,735,830	3,887,268	9,905	304,277	3,592,896	263,858
Florida East Coast	584	240,867	172,950	4[illegible]217	96,159	106,899	10,510	224,807	21,721	460,096	25,121	.....	34,633	—9,512	138,638
Fort Worth & Denver City	454	748,617	516,943	1,324,025	151,607	168,079	23,324	359,369	40,008	742,387	581,638	1,373	27,900	555,111	101,375
Grand Rapids & Indiana	591	678,783	596,814	1,354,540	166,225	198,015	32,633	498,170	40,130	935,173	419,367	945	63,398	356,914	—44,520
Gulf, Colorado & Santa Fe	1,518	1,964,376	786,493	2,932,033	559,460	438,774	64,884	1,046,223	85,948	2,195,289	736,744	.....	96,269	640,475	—118,853
Hocking Valley	350	1,585,580	264,276	1,908,221	246,697	355,976	22,662	473,985	35,111	1,134,431	773,790	59,684	64,082	769,392	75,435
Kansas City Southern	827	1,537,478	368,844	2,129,658	261,735	301,349	75,943	717,279	85,043	1,441,349	688,309	.....	75,286	613,023	—128,536
Lehigh Valley	1,441	6,841,082	1,406,524	8,568,324	1,019,976	1,470,734	233,711	2,372,438	181,320	5,278,179	3,290,145	21,141	283,800	3,027,486	259,890
Louisville & Nashville	4,398	8,618,598	2,826,321	12,137,952	1,372,417	1,943,452	262,827	3,535,226	239,933	7,353,855	4,784,097	—14,690	373,830	4,395,577	771,718
Maine Central	932	1,293,555	1,035,506	2,470,016	382,292	300,661	23,918	743,771	58,639	1,509,281	960,735	19,120	95,885	883,970	160,4.7
New York, Chicago & St. Louis	558	2,003,965	465,001	2,554,146	283,409	267,685	146,021	884,819	38,197	1,620,131	934,015	—2,100	99,000	832,915	227,201
New York, New Haven & Hartford	2,041	7,257,757	7,006,192	15,552,160	1,765,229	1,565,183	84,259	5,449,627	349,579	9,213,877	6,338,283	368,555	895,000	5,811,838	1,610,403
Norfolk & Southern	582	376,051	201,279	633,671	77,321	78,491	14,319	191,028	41,344	402,503	231,168	2,878	17,700	216,346	96,498
Norfolk & Western	1,941	7,106,961	1,138,698	8,507,650	867,259	1,446,144	133,599	2,307,513	175,795	4,930,310	3,577,340	—4,243	252,000	3,321,097	589,465
Northern Pacific	5,657	12,116,850	7,925,231	21,198,295	3,011,261	2 349,280	255,450	5,586,606	272,071	11,474,668	9.723,627	277,770	805,535	9,195,862	1,065,719
Pennsylvania Company	1,416	10,916,475	2,207,520	14,067,027	1,746,41[illegible]	2,014,203	208,804	3,841,484	213,749	8,024,659	6,042,368	—5,334	431,710	5,605,324	1,252,710
Pittsburgh, Cincinnati, C. & St. L.	1,468	6,474,061	2,135,060	9,611,393	1,387,158	1,602,578	197.175	2,910,901	170,480	6,268,292	3,343,101	—2,584	331,515	3,009,002	413,529
San Antonio & Aransas Pass	727	688,550	278,741	1,018,802	128,457	129,300	13,175	362,065	26,662	659,659	359,143	.....	27,000	332,143	—27,927
Texas & Pacific	1,884	2,337,840	977,812	3,511,679	501,767	620,649	56,952	1,313,419	102,007	2,594,794	916,885	—10,993	114,200	791,692	176,348
Wheeling & Lake Erie	458§	1,529,664	180,570	1,851,141	207,360	429,734	21.873	554,238	47,623	1,260,828	590,313	20,153	69,511	540,954	123,502
Vandalia	827	1,516,480	632,414	2,391,013	348,298	411,274	74,837	820,289	56,498	1,711,196	679,817	.....	71,415	608,402	71,520

*Mileage operated September 30, 1908, 4.406; †mileage operated September 30, 1908, 744; ‡mileage operated September 30, 1908, 1,901; §mileage operated September 30, 1908, 442. — Indicates Deficits, Losses and Decreases.

Hearing in Reno Rate Case.

Commissioners Prouty, Lane, Clements and Clark, of the Interstate Commerce Commission, took testimony on October 25 at Reno, Nev., in the proceeding instituted by the Nevada Railway Commission to secure Pacific coast terminal rates for Reno. Commissioner Henry Thurtell, of Nevada, introduced tabulations to show the effect on the earnings of the Southern Pacific on its traffic to Reno if the petition were granted. These indicated that the receipts of the Southern Pacific in 1908 from shipments to Reno were $153,221, and that under the proposed rates its earnings from traffic to Reno would be $62,743. Mr. Thurtell sought to show, however, that this reduction would not be serious for the Southern Pacific in view of its very large aggregate net revenues.

Turkish Railways.

The following abstract of the operations of the railways of Turkey in 1907 is taken from a consular report:

Companies.	Length, miles.	Gross receipts.	Guarantees paid by government.	Total receipts.
Salonika-Monastir	136	$527,526	$76,522	$604,048
Aaida Pasha-Angora	642	1,230,117	349,659	1,579,776
Eski Chehir-Konia	642	599,609	578,952	1,178,561
Hamidie-Ada Bazar	...*	25,526	.....	25,526
Bagdad	124	67,721	530,579	598,300
Mersine-Adana	42	149,177	.....	149,177
Aiden Railway	321	1,553,958	.....	1,553,958
Oriental railways	786	†3,100,383	.....	2,474,265
Salonika-Constantinople	317	463,348	1,063,723	1,527,071
Smyrna-Cassaba	321	760,607	65,526	826,133
Smyrna-Cassaba extens'n.		245,353	669,846	915,199
Damascus-Hamah and extensions:				
Old line		805,194	.....	805,194
Port of Beirut		21,280	.....	21,280
Rayak-Hamah and Aleppo		261.998	404,025	666,023
Hamah-Aleppo		86,298	.....	86,298
Total	360	$1,174,770	$404,025	$1,578,795
Jaffa-Jerusalem	54	$216,278	.....	$216,278
Moudania-Brussa	25	75,744	.....	75,744
Grand total		$10,190,117	$3,738,832	$13,302,831

*Not given. †Less $626,118 paid to the government.

STATE COMMISSIONS.

Harry S. Calvert, secretary of the Pennsylvania State Railroad Commission at Pittsburgh, Pa., has resigned, to become receiver of a Pittsburgh trust company, effective November 9.

The Railroad Commission of Indiana has ordered all steam railways operating in Indiana to make it a rule to stop all trains being operated on an industrial switch or spur before crossing the track of an interurban railway.

The Texas Railway Commission on October 23 issued an order placing a new and corrected valuation on the property of the Houston & Texas Central from Waco to Rotan. The former valuation was $3,698,452. The commission finds that betterments have been made amounting to $1,309,725, and the total value of the physical property $4,209,725. The commission estimates the value of the franchise of the company to be 6 per cent. of the value of the physical property. It, therefore, fixes the total valuation at $5,202,668. The road last April filed an application for authority to issue stocks and bonds aggregating $5,000,000. The valuation now made has the effect of granting this application.

COURT NEWS.

In the state district court at Waxahachie, Tex., October 23, in a suit for personal injury against the Houston & Texas Central, a jury awarded Austin Hickman $60,000 damages. This is said to be the largest indemnity ever granted, even in Texas, a state of large indemnities. Hickman was run over by a train a year ago and lost both hands and both feet.

Whether the state of Oregon can collect a forfeit of $10,000 from a railway for not complying with an order of the state railway commission to build and equip a station will be tested in a suit that has been brought in the state circuit court for Linn county. The people of Lyons, in that county, petitioned the railway commission to compel the railway to establish a station there, and the commission, after a hearing, issued the order. The railway refused to obey on the ground that the commission did not have the power to make such an order, and the commission brought suit to collect from it the penalty stated.

The Illinois supreme court rendered a decision on October 26 holding the city of Chicago liable for the destruction of the cars of railways during the strike of the American Railway Union in 1894, under the leadership of Eugene V. Debs. The court said that the city was responsible for the cars whether they were owned by the companies on whose tracks they were burned or not. The suit was a test case brought by the Pennsylvania Company, which was awarded $100,000 damages. Other railways will now press similar suits. The total damages asked by all lines aggregate about $700,000. It is understood that the city will appeal the Pennsylvania case to the United States supreme court.

George J. Kindel, of Denver, Colo., who, perhaps, has brought and lost more rate cases against railways than any other man in the United States, lost another such case in the state district court at Denver on October 26. He sued the Colorado & Southern for $294.26 for having collected from him alleged excessive freight rates. The court held that it had no jurisdiction to fix railway rates; that it was the province of the state railway commission to hear complaints and determine on the evidence submitted whether or not the rates exacted by the railways were excessive. Mr. Kindel's charge was based on the ground that its rates were higher per ton per mile than the rates the same road charged for hauling coal similar distances in Colorado and other states. The railway refused to introduce any testimony, contending that since Mr. Kindel had charged that the rates were excessive the burden of proof was on him.

Judge Charlton, in the superior court of Chatham county, Georgia, has decided in favor of S. G. McLendon on all the points of his suit to be reinstated as railway commissioner. Mr. McLendon, former chairman of the commission, was deposed by Gov. Hoke Smith when the latter was Governor because McLendon voted against Smith's proposal to reduce freight rates. After Gov. Smith had ousted McLendon and the legislature had endorsed the action, Joseph M. Brown, the new Governor, appointed Joseph F. Gray, of Savannah, to fill the vacancy. McLendon filed quo warranto proceedings to oust Gray from office. Judge Charlton has now rendered a decision, in which he upholds the contention of McLendon in every detail, and the case will go to the supreme court of Georgia for final adjudication. McLendon was represented before Judge Charlton by three former justices of the supreme court, who it is understood volunteered their services in his behalf.

The Oklahoma supreme court has overruled the motion of the state corporation commission for dismissal of appeals taken to the court by various railways from orders of the commission. The court said that the state constitution makes it the duty of the commission in fixing rates to make findings of the facts upon which its rate orders are based. On appeal from its orders it must certify the findings of fact to the supreme court. When the commission fails to so certify the facts the court may remand the cases to the commission with instructions to find the facts upon which its orders are based and certify them before an appeal is taken. The cases in which the motions to dismiss were overruled were that of the Atchison, Topeka & Santa Fe et al., appealing from coal rate orders; that of the St. Louis & San Francisco et al., appealing from cement and lime rate orders; that of the St. Louis, Iron Mountain & Southern, appealing from hay and grain rate orders; that of the Kansas City, Mexico & Orient, appealing from a fruit and vegetable order; that of the Chicago, Rock Island & Pacific et al., appealing from a cottonseed rate order; and that of the Missouri, Kansas & Texas, appealing from a lumber rate order. The contention of the commission in these cases was in substance that it was the judge of the facts in each case and that appeals from it could be taken to the supreme court only on questions of law.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Urban H. Broughton has been elected president of the Virginian Railway, succeeding Henry H. Rogers, deceased.

Robert S. Lovett, who was recently elected president of the Union Pacific and the Oregon Short Line, has been elected also president of the Southern Pacific.

M. W. Glover, auditor of the Ohio Electric Lines at Cincinnati, Ohio, has been appointed assistant to the traffic manager of the Illinois Traction System, with office at Springfield, Ill.

W. R. Mozier has been appointed auditor of freight accounts of the Toledo, Peoria & Western and of the Chicago & Alton, and F. B. Smith has been appointed auditor of passenger accounts, both with offices at Chicago.

Charles H. Schlacks, vice-president of the Denver & Rio Grande, at Denver, Colo., has been elected also first vice-president of the Wastern Pacific, with office for both companies at San Francisco, Cal. Charles M. Levey, third vice-president of the Northern Pacific at St. Paul, Minn., has been elected a director, second vice-president and general manager of the Western Pacific, with office at San Francisco.

George T. Slade, general manager of the Northern Pacific lines east of Paradise at St. Paul, Minn., has been appointed third vice-president, in charge of maintenance and operation of all Northern Pacific lines, with office at St. Paul, succeeding C. M. Levey, resigned to accept service elsewhere. H. C. Nutt, general manager of the lines west of Paradise, at Tacoma, Wash., has been appointed also fourth vice-president.

Julius Kruttschnitt, director of maintenance and operation of the Harriman Lines, and vice-president of the Southern Pacific, and J. C. Stubbs, traffic director of the Harriman Lines and vice-president of the Southern Pacific, have each been elected vice-president also of the Union Pacific. The elections of Messrs. Kruttschnitt and Stubbs as vice-presidents of the Union Pacific are, in a way, only a matter of form, as they had charge before of the maintenance and operation and the traffic departments, respectively, of the Union Pacific as well as of all the other Harriman lines. The additional titles which they have been given are mainly in the nature of compliments to them and will, perhaps, enable them to exercise certain powers which they technically could not have exercised before. The positions which they occupy in the railway world are so well known and are so pre-eminent that it may be almost superfluous to refer to them. Mr. Harriman chose them from among all of the operating and traffic officers of his railway system to be his chief aids in the direct management of the properties. Under him they really performed in their respective departments duties which on most railways are performed by the president. Perhaps the reasons which caused Mr. Harriman to create the offices they hold and to appoint them to those offices were never so well stated as by Mr. Kruttschnitt in the paper on the operating organization of the Union Pacific and Southern Pacific systems, which he read before the New York Railroad Club last May. Mr. Kruttschnitt said: "Mr. Harriman is a firm believer in team work, and in turning over the management of the properties to his two co-ordinate representatives in Chicago, with the injunction that on them rested the responsibility for net results, he struck the keynote of the entire organization. From the Chicago offices down to the divisions the traffic officers co-operate as loyally to secure low operating results as the operating officers do to promote business and secure new traffic." Speaking of the duties of his own office, Mr. Kruttschnitt said it "standardizes and correlates, supervises and investigates, comments and criticizes, equalizes and differentiates as among different properties, but leaves each to work out its own problems of administration." This description of the duties of the office of the director of maintenance and operation applies equally well to the duties of the office of traffic director. The wonderful prosperity of the Harriman Lines in recent years has been due in very large measure to the way in which the offices of Mr. Kruttschnitt and Mr. Stubbs have been administered, and no man would undertake to say which of these two eminent railway experts has contributed the more to securing those results. Each has contributed his share toward making the net earnings of the system as a whole one of the wonders of the railway world.

Mr. Kruttschnitt was born July 30, 1854, at New Orleans, La. He graduated as a civil engineer from Washington and Lee University in 1873, and for some years after graduation was a teacher in a school for boys near Baltimore, Md. He began railway work in 1878 as an engineer with Morgan's Louisiana & Texas Railroad & Steamship Company. On January 1, 1880, he was made roadmaster of the Western division and in the following year became assistant chief engineer and general roadmaster. He was appointed chief engineer and superintendent in April, 1883. He became assistant manager of the Atlantic system of the Southern Pacific in October, 1885, and was made general manager of that system as well as vice-president of the Galveston, Harrisburg & San Antonio and of the Texas & New Orleans in July, 1889, which positions he held for six years. He was then, until April, 1904, general manager of all lines of the Southern Pacific Company, having been made vice-president in April, 1898. In April, 1904, he was made director of maintenance and operation of the Harriman system.

J. Kruttschnitt.

Mr. Stubbs was born May 31, 1847, at Ashland, Ohio. He began railway work in 1869 as clerk in the general freight office of the Pittsburgh, Cincinnati & St. Louis at Columbus, Ohio. Later in that year he went to the Central Pacific as chief clerk at Sacramento, Cal., and he became assistant general freight agent in December, 1871. Two years later he was made general freight agent, and in May, 1882, was appointed freight traffic manager. He was later appointed general traffic manager, and in February, 1885, was appointed general traffic manager of the Southern Pacific. He was elected third vice-president of the Southern Pacific in December, 1889. In July, 1901, he was made traffic director of the Harriman system.

J. C. Stubbs.

A. A. Allen, vice-president and general manager of the Missouri, Kansas & Texas, whose election as president has been announced in these columns, was born in 1855, at Monmouth, Ill. He received a common school education and began railway work in 1869 as telegraph messenger for the Chicago, Burlington & Quincy. He was later assistant operator, operator and clerk with the same road, and in the eight years be-

ginning 1872 he was consecutively ticket agent and operator, assistant train despatcher and train despatcher of the Toledo, Peoria & Warsaw, now the Toledo, Peoria & Western. During the next two years he was city ticket agent at Chicago and trainmaster at Peoria, Ill., for the Wabash, St. Louis & Pacific, now a part of the Wabash. In 1882 he became division superintendent for the Wisconsin Central, and he was promoted to various positions in the operating department until in 1889 he was assistant general manager. In the latter year he was made general manager of the Chicago & Northern Pacific and the Chicago & Calumet Terminal, now a part of the Chicago Terminal Transfer. He was made superintendent of construction of the Everett & Monte Cristo Railroad in 1892, and the next year became general superintendent of the Missouri, Kansas & Texas. In February, 1895, he was made assistant general manager, and was elected vice-president and general manager in May, 1897, which position he held until his recent election as president.

Operating Officers.

W. L. Connelly has been appointed trainmaster of the Danville division of the Chicago, Indiana & Southern, with office at Danville, Ill.

T. J. McCune has been appointed trainmaster of the National Railways of Mexico, with office at Monterey, N. Leon, Mex., succeeding H. H. Allison, transferred.

George A. Goodell, general superintendent of the Middle district of the Northern Pacific at Livingston, Mont., has been appointed general manager of the lines east of Paradise, with office at St. Paul, Minn., succeeding George T. Slade, appointed vice-president. C. L. Nichols, superintendent of the Montana division at Livingston, succeeds Mr. Goodell.

S. K. Blair, division superintendent of the Fort Wayne division of the New York, Chicago & St. Louis at Fort Wayne, Ind., having been granted temporary leave of absence on account of ill health, the jurisdiction of R. W. Mitchener, superintendent of the Cleveland division at Cleveland, Ohio, will be extended over the Fort Wayne division, with office at Fort Wayne for that division.

W. A. Whitney, superintendent of the Eastern division of the Union Pacific at Ogden, Utah, has been appointed superintendent of the Western division of the Southern Pacific, with office at Oakland Pier, Cal., succeeding W. A. McGovern, resigned. W. M. Jeffers, assistant superintendent at Ogden, succeeds Mr. Whitney, and F. A. Law, chief despatcher at Green River, Wyo., succeeds Mr. Jeffers.

The Eastern division of the Chicago & Alton, comprising all lines in Illinois, having been divided into two divisions, J. W. Mulhern, superintendent at Bloomington, Ill., will have jurisdiction over the northern part, and C. F. Smith, superintendent of telegraph at Bloomington, will have jurisdiction over the southern part, both with offices at Bloomington. Thomas M. Haston succeeds Mr. Smith.

The Hine system of organization having been established on the Colorado lines of the Union Pacific, the following officers will hereafter be designated as assistant superintendents: S. R. Toucey, assistant superintendent; J. A. Turtle, master mechanic; G. F. Davis, division engineer; F. M. Jones, trainmaster; J. F. Nally, traveling engineer, and N. C. Martin, assistant division engineer, all with offices at Denver, Colo.

George H. Saunders, trainmaster of the Oklahoma division of the Atchison, Topeka & Santa Fe at Arkansas City, Kan., has been appointed assistant superintendent, in charge of transportation, with office at Arkansas City. W. W. Drake succeeds Mr. Saunders. T. Cunningham has been appointed trainmaster of the Southern Kansas division, with office at Chanute, Kan., and G. G. Derby has been appointed assistant trainmaster of the Middle division, with office at Newton, Kan.

Traffic Officers.

R. J. McNeil has been appointed district passenger agent of the Canadian Pacific, with office at Nelson, B. C.

Grantley B. Harper has been appointed an industrial agent of the Illinois Central, with office at Memphis, Tenn.

J. R. Veitch, assistant general freight agent of the Pere Marquette at Chicago, has been appointed a general agent of the Chicago, Milwaukee & Puget Sound, with office at Portland, Ore.

Eugene W. Clapp, district freight and passenger agent of the Southern Pacific at Reno, Nev., has been transferred to Fresno, Cal. J. F. Hixson succeeds Mr. Clapp.

George M. Wagner has been appointed a traveling freight agent of the Wabash, with office at Cincinnati, Ohio, succeeding E. J. Wilson, resigned to go into other business.

The following have been appointed general agents of the Colorado Midland: Malone Joyce, with office at Los Angeles, Cal.; O. F. Spindler, with office at Pittsburgh, Pa.; J. H. Davis, with office at St. Louis, Mo.

Gentry Waldo, general agent in the freight department of the Galveston, Harrisburg & San Antonio at Galveston, Tex., has been appointed general agent of the Southern Pacific Steamship Company, with office at Galveston.

F. A. Butterworth, manager of the Pere Marquette-Lehigh Valley fast freight line, has been appointed assistant general freight agent of the Pere Marquette, with office at Chicago, succeeding J. R. Veitch, resigned to accept service elsewhere.

Charles S. Wight, manager freight traffic of the Baltimore & Ohio, has been appointed general traffic manager in charge of both freight and passenger business, with office at Baltimore, Md., and the offices of manager freight traffic and manager passenger traffic have been abolished.

The following have been appointed commercial agents of the Mobile & Ohio: R. L. DePew, with office at St. Louis, Mo., and G. W. Sargent, with office at Chicago. A. S. Birchett has been appointed soliciting freight agent and G. T. Dickson traveling freight agent, both with offices at St. Louis.

James B. Scott, New England passenger agent of the Baltimore & Ohio at Boston, Mass., has been appointed general eastern passenger agent, with office at New York, succeeding Lyman McCarty, deceased. H. B. Faroat, city passenger agent at New York, succeeds Mr. Scott, with office at Boston.

E. C. Coffey, assistant general freight agent of the Chicago & Alton at Peoria, Ill., has been appointed also assistant general freight agent of the Iowa Central and the Minneapolis & St. Louis, with office at Peoria, succeeding A. P. Bryant, assigned to other duties.

Mark Fenton, traveling freight agent of the Illinois Central at Bloomington, Ill., has been appointed industrial agent for the western and northwestern lines, with office at Bloomington. C. C. Backus, traveling freight agent of the refrigerator service, succeeds Mr. Fenton, and G. D. Shafer succeeds Mr. Backus, with office at Chicago.

J. N. Merrill, general southern agent of the Chicago, Burlington & Quincy at Birmingham, Ala., has been appointed Florida agent, with office at Messina, Lake County, Fla. H. R. Todd, general agent at St. Louis, Mo., succeeds Mr. Merrill. G. H. Gray, chief clerk to the assistant general freight agent at Kansas City, Mo., has been appointed commercial agent, with office at St. Louis.

Fred Zimmerman, whose appointment as general freight agent of the Indiana Harbor Belt Railroad, with office at Chicago, has been announced in these columns, was born July 26, 1866, at Portland, Me. He received a public school education in Chicago and began railway work in June, 1882. He was consecutively until October, 1883, office boy and clerk with the Green, Kankakee, Chicago & Louisville Southern and Southern Despatch fast freight lines. He was then until April, 1887, clerk for the Chicago & Ohio River Pool and was later rate and tariff clerk in the general freight department of the Louisville, New Albany & Chicago, now a part of the Chicago, Indianapolis & Louisville. In February, 1890, he became tariff and percentage clerk in the general freight department of the Michigan Central at Chicago and at Detroit, Mich. From April, 1897, to October, 1899, he was chief clerk in the same department at Detroit, and on the latter date was made assistant general freight agent at Buffalo, N. Y. In July, 1900, he was appointed assistant general freight agent, with office at Chicago, which position he held until his recent appointment as general freight agent of the Indiana Harbor Belt.

Engineering and Rolling Stock Officers.

J. N. Mowery, mechanical engineer of the Lehigh Valley at South Bethlehem, Pa., has been appointed an assistant master mechanic of the Auburn division, with office at Auburn, N. Y.

Edward Mahoy has been appointed master of trains and engines of the Detroit, Toledo & Ironton, with office at Springfield, Ohio, succeeding B. Powers, resigned to accept service elsewhere.

T. W. Fatherson has been appointed a district engineer of the Choctaw district of the Chicago, Rock Island & Pacific with office at Little Rock, Ark., succeeding H. G. Clark, assigned to other duties.

George O. Lundy has been appointed a supervisor of the Philadelphia & Reading, with jurisdiction over the Reading, Columbia, Schuylkill and Lehigh divisions, with office at Reading, Pa., succeeding William Zeller, retired.

John G. Neuffer, formerly superintendent of machinery of the Illinois Central, the Yazoo & Mississippi Valley and the Indianapolis Southern at Chicago, has been appointed superintendent of motive power of the Chicago Great Western, with office at Chicago, succeeding W. E. Symons, assigned to special service.

Peter H. Peck, for 21 years master mechanic of the Chicago & Western Indiana and the Belt Railroad of Chicago, who was granted a leave of absence from that position in August, 1908, has resigned his office and has been appointed secretary and treasurer of the Belt Line Coal Company, with office at Chicago. Mr. Peck was born November 28, 1844, at Cerro Gordo, Ill. He was in the United States army from 1862 to 1865, taking part in 14 battles in the Tennessee and Atlanta campaigns. He began railway work in July, 1865, as locomotive fireman on the Des Moines Valley Railway and later was engineman on the Keokuk & Des Moines, both of which roads are now a part of the Chicago, Rock Island & Pacific. In January, 1876, he went to the St. Louis, Keokuk & Northwestern, now a part of the Chicago, Burlington & Quincy, and in 1878 to the Hannibal & St. Joseph, also now a part of the Burlington. In November, 1882, he was made division master mechanic of the latter road, in which position he remained for five years, becoming master mechanic of the Chicago & Western Indiana and the Belt Railways in May, 1887. He was president of the Western Railway Club in 1903, was president of the American Railway Master Mechanics' Association from 1904 to 1905, and was president of the Car Foremen's Association in 1908.

Peter H. Peck

Thomas Mahar has been appointed master mechanic of the Harlem division of the New York Central & Hudson River, succeeding H. B. Whipple, resigned, and also master mechanic of the Putnam division on account of duties transferred from the master mechanic of the Hudson division; his office is at White Plains, N. Y.

John Reddy, roadmaster of the Southern Pacific lines east of Sparks, at Wells, Nev., has been transferred from the Wells district, and will have his office at Ogden, Utah, succeeding J. A. Allen, deceased. A. E. Moquist, roadmaster at Mina, Nev., succeeds Mr. Reddy and Frank Reilly succeeds Mr. Moquist.

C. A. Morse, chief engineer of the lines of the Atchison, Topeka & Santa Fe east of Albuquerque, N. Mex., at Topeka, Kan., has been appointed chief engineer in charge of maintenance and improvement of the Atchison, Topeka & Santa Fe system, succeeding W. B. Storey, Jr., recently elected vice-president. Mr. Morse will retain his office at Topeka for the present.

R. C. Burns has been appointed general air-brake and steam-heat inspector of the Pennsylvania, attached to the office of general superintendent of motive power at Altoona, Pa. He will confer with superintendents of motive power, master mechanics, general foremen and others on questions relating to his duties. His territory includes the Philadelphia, Baltimore & Washington, Northern Central and West Jersey & Seashore.

L. C. Fritch, consulting engineer of the Illinois Central at Chicago, has been appointed chief engineer of the Chicago Great Western, with office at Chicago, succeeding W. H. Chadbourn, and the office of consulting engineer of the Illinois Central has been abolished. Mr. Fritch was promoted from assistant to the president of the Illinois Central to consulting engineer in February, 1909. His photograph and a sketch of his life were published in these columns February 12 last.

Purchasing Officers.

D. M. Ferry has been appointed paymaster and purchasing agent of the Louisville, Henderson & St. Louis, with office at Louisville, Ky., succeeding F. Cox, resigned.

B. Briard has been appointed purchasing agent of the Chicago Great Western, with office at Chicago, succeeding A. D. Ward, resigned to engage in other business.

OBITUARY.

S. E. Kirk, general agent of the Wheeling & Lake Erie at Detroit, Mich., died recently.

Joseph H. Turner, general agent of the Nashville, Chattanooga & St. Louis at Memphis, Tenn., died on October 28 at the age of 55 years.

Frank Wheeler, commercial agent of the Lake Shore & Michigan Southern, with office at Youngstown, Ohio, died at Youngstown on October 24.

John Stewart Kennedy, a director of many railway and other corporations, died at his home in New York on October 31. He was born in 1830 in Blantuire, Scotland. In 1857 he became a member of the banking firm of M. K. Jesup & Co. Mr. Kennedy was associated with James J. Hill in the development of railways in the northwest and helped to furnish the money for building what is now the Great Northern. He was also one of the syndicate that contracted with the Canadian government to build a Canadian Pacific line. He was one of the incorporators of the Union Pacific. Among the companies of which he was a director are the Northern Pacific, the New York, Chicago & St. Louis, the Northern Securities Co., of which he was vice-president, and the Fort Wayne & Chicago.

Michael T. Donovan, freight traffic manager of the Boston & Maine at Boston, Mass., died October 27, after several months' illness, at the age of 52 years. Mr. Donovan was born on November 17, 1857, at Concord, N. H., and received his education in the common schools. He began railway work as a clerk in the office of the Boston & Lowell, now part of the Boston & Maine, in 1878 at Boston, Mass., since which time he has been consecutively chief clerk of freight accounts, chief clerk in the claim department and chief clerk in the general freight office. He became assistant general freight agent in September, 1887, of the Concord Railway, now part of the Boston & Maine, at Concord, N. H., and the following June went to Boston in charge of the office of the Canadian Pacific Despatch Fast Freight Line, operated by the Boston & Maine and the Canadian Pacific, remaining in that position until February, 1891, when he was appointed assistant to the general freight agent of the Boston & Maine, becoming general freight agent in August, 1892. He was promoted to freight traffic manager in August, 1900, which position he held at the time of his death.

Railroad Construction.

New Incorporations, Surveys, Etc.

Anacoco Valley.—Incorporated in Louisiana with $25,000 capital and office at Grabow, in Calcasieu parish. The incorporators are identified with the Galloway Lumber Co., of Grabow, and the plans are to build lines into the timber sections as well as to the farming country in the Anacoco and Sabine valley, near Almandane. M. M. Galloway, president and general manager; J. U. Kerr, vice-president, and M. Galloway, secretary and treasurer.

Arizona & Swansea.—Work is said to be under way on a line from Swansea, Ariz., to Bouse, 16 miles, and track laying is to be started at once. H. L. Fishel is the engineer in charge.

Canadian Northern Ontario.—An officer writes that the contract given to Angus Sinclair, of Toronto, is for work on a section of the Toronto-Ottawa line. The route is via North Pickering, thence east one or two miles north of Whitby, Oshawa, Bowmanville and Newcastle to Port Hope, and via Cobourg, Grafton, Colborne and Brighton to Trenton. Work is to be started at once. The first 15 miles will be heavy and the rest is all earthwork. There will be about six viaducts, averaging 600 ft. each, on this section. (Oct. 8, p. 659.)

Canadian Pacific.—According to press reports application has been made for a two years' extension in which to build a line from Blairton, Ont., southwest via Campbellton through Peterboro, Hastings and Northumberland counties to Coburg, thence westerly via Port Hope, New Castle, Bowmanville, Oshawa and Whitby, through Durham, Ontario and York counties, to a point on the Canadian Pacific between Locust Hill and Leaside Junction.

Central New England.—The New York Public Service Commission, Second district, has granted permission to this company to change the route of its existing single track and to lay an additional track in Dutchess county, beginning at Fishkill plains, in the town of East Fishkill, through Wappinger, La Grange and Poughkeepsie to Poughkeepsie junction, 9.25 miles. The grade crossings at Didells road, in the town of Wappinger, Smith's and Daly's road, in the towns of Wappinger and La Grange, Freedom plains road and the Pleasant valley road at Manchester bridge will be eliminated and overhead crossings provided. The cost of the overhead crossings to be paid for by the railway company.

Chicago & North Western.—Surveys are said to be under way from Iroquois, which is 20 miles east of Huron north to Doland, on the line in Spink county, 45 miles. It is understood that the work will be pushed as rapidly as possible.

Chicago, Milwaukee & Puget Sound.—An officer writes that track is now being laid between McKenna, Wash., and Gates City, and that the Gray's Harbor & Puget Sound, a subsidiary line of the Union Pacific, is now laying tracks between Gates City and Hoquiam via Cosmopolis and Aberdeen. The C., M. & P. S. has secured a half interest in the line between Gates City and Hoquiam, which will be used jointly with the Harriman lines. It is expected that the line between McKenna and Gates City and the joint line from that place west to Gray's Harbor will be finished by January, 1910, and freight service will be immediately opened by the C., M. & P. S. It is undecided when passenger service will be started on the line. (Oct. 8, p. 660.)

Cincinnati, Louisville & Maysville Traction.—Surveys are said to be under way for a line from Cincinnati, Ohio, south to Lexington, Ky., and from Maysville west to Louisville, with a connection to Dry Ridge, in Grant county, in all about 250 miles. Surveys for the section from Walton north to Covington are not yet made. W. T. S. Blackburn, president, Dry Ridge; J. Glascock, vice-president, Williamstown, and J. McCoy, secretary, Dry Ridge. (April 30, p. 960.)

Cisco & Santa Anna Central.—According to press reports residents of Santa Anna, Tex., and Cisco are back of a project to build from Cisco south to Santa Anna, 50 miles, and eventually south to Spofford Junction. Preliminary surveys are said to have been made.

Cleveland, Cincinnati, Chicago & St. Louis.—An officer writes regarding the report that funds are being secured to build the Evansville, Mount Carmel & Northern from Mount Carmel, Ill., south to Evansville, Ind., 43 miles, that up to the present time nothing has been done toward securing funds for building this line. (Oct. 15, p. 725.)

In regard to double-tracking the Cleveland-Indianapolis division, the question of double-tracking from Indianapolis to Anderson is under consideration, but it has not yet been determined to carry out the work.

Coffeyville & Nowata Railroad & Power Co.—Incorporated in Oklahoma, with $200,000 capital, to build from Coffeyville, Kan., south to Nowata, Okla., 23 miles. The incorporators include: J. D. Pollard, of Kansas City, Mo.; W. P. Brown, of Coffeyville; J. C. Denton, W. V. Thraves and J. A. Tillotson, of Nowata.

Copper River Railroad.—According to press reports about 3,000 men are now at work on this line, building from Cordova, Alaska, north toward the Copper river. Plans are being made to put about 1,100 additional men on the work, which, it is expected, will be carried on during the winter. The line has been extended north for 82 miles from Cordova. (Aug. 27, p. 383.)

Cumberland Valley.—Work is now under way near Carlisle, Pa., building a two and one-half mile cut-off and other improvements have been planned. A proposition has been made to the towns of Chambersburg and Mechanicsburg for a change of line through those places and the elimination of all grade crossings. This plan has been rejected by both towns and the work is indefinitely postponed.

Denver, Boulder & Western.—According to press reports about $100,000 will be spent for betterments and equipment next year. The plans provide for several extensions in Colorado, one of which is to run to Nederland and another to Lakeville, to the new camp of the Primos Company, which is building a big mill on the Boulder county ranch.

Des Chutes.—See Union Pacific.

Duluth, South Shore & Atlantic.—An officer writes that the company will build 3.65 miles of line from Eagle Mills, Mich., to the intersection with the main line one-half mile east of Negaunee and that the work will be done by the company's men. Maximum grades will be one and one-half per cent., maximum curvature three degrees. There will be one 45-ft. steel plate girder bridge. (Aug. 27, p. 383.)

Elizabethtown Terminal.—Application has been made to the New York Public Service Commission, Second district, for a certificate of convenience and necessity to build from Westport, N. Y., which is on the Delaware & Hudson, to Elizabethtown, eight miles. G. W. Jenkins, president, and V. R. Coon, chief engineer, Elizabethtown. (Oct. 15, p. 725.)

Evansville, Mount Carmel & Northern.—See Cleveland, Cincinnati, Chicago & St. Louis.

Garden City, Gulf & Northern.—An officer writes that track-laying is expected to be finished from Garden City, Kan., west to Scott City, about 40 miles, where connection is to be made with the Atchison, Topeka & Santa Fe and the Missouri Pacific. Trains are to be put in operation by December 15. (Oct. 22, p. 777.)

Gulf, Brownwood & Cisco.—Contracts are to be let between December 15 and January 1 to build from Brownwood, Tex., northeast via Cleo, May and Rising Star to Romney. S. F. Johnson, of the Brownwood Commercial Club, Brownwood, may be addressed.

Gray's Harbor & Puget Sound.—See Chicago, Milwaukee & Puget Sound.

Great Northern.—An officer writes that a contract has been given to A. B. Cook & Co., of Helena, Mont., and work is under way on a revision of the line from Belt, Mont., to Gerber, about 22 miles. (Oct. 1, p. 613).

Kansas City, Ozark & Southern (Electric).—This company is said to have finished building its line and trains were to be put in operation on November 1, from Mansfield, Mo., in Wright county, southeast to Ava, 17 miles. It is the intention

to further extend the line north from Mansfield and south from Ava. (Mar. 19, p. 655.)

KNOXVILLE, SEVIERVILLE & EASTERN.—An officer writes that grading has been finished and track is laid on 14 miles of this line, building from Knoxville, Tenn., southeast to Sevierville, 30 miles. Maximum grade will be 1.25 per cent. and maximum curvature 8 deg. The Revile Construction Co., of Knoxville, Tenn., are the contractors. C. S. McManus, president, and W. A. Seymour, chief engineer, both of Knoxville. (March 19, p. 655.)

LAKE ERIE & YOUNGSTOWN (ELECTRIC).—This company, which was organized about two years ago to build from Conneaut, Ohio, south via Andover to Youngstown, 60 miles, is said to have started work on the line. The Stanley Contracting Co. is said to have the general contract. A mortgage was recently given to secure funds for building the line and securing equipment. J. H. Ruhlman, president, Youngstown. The incorporators include: W. F. Stanley, F. J. Cheney, G. M. Brown and A. W. Jones. M. Kahn, 42 Broadway, New York, is said to be interested. (Aug. 20, p. 339.)

MONONGAHELA RAILROAD.—An officer writes regarding the reports that surveys are being made for an extension of this road into the coal fields of West Virginia to Port Marion, as well as to the coal fields in Green county, that no decision has been reached by this company regarding extensions.

NEW YORK SUBWAY.—The Board of Estimate and Apportionment at a recent meeting approved the action of the New York Public Service Commission, First District, in awarding contracts for the Fourth avenue subway in Brooklyn, and an appropriation of $2,850,000 was made for the beginning of the work. See mention of this improvement in another column. (July 9, p. 79.)

OHIO ROADS (ELECTRIC).—According to press reports from Alliance, Ohio, an electric line is to be built from that place northwest to Ravenna, about 20 miles. Grading work is to be started this fall. A company is to be formed, in which C. R. Morley, of the Stark Electric Railroad, and Henry M. Everett, of the Northern Electric Traction & Light Co., both with offices at Cleveland, will be interested.

OREGON ELECTRIC.—Bonds are to be sold by this company to raise funds for building extensions of the Willamette Valley lines, on which work is to be started soon. Extensions have been surveyed from Salem, Ore., east, also south and west, to various places. One of the important projected branches is to be built from a connection with the main line south to Corvallis. It is understood that the work first to be carried out will be from Salem to Albany, 30 miles. (May 7, p. 1008.)

OSAGE & WESTERN.—According to press reports work is to be started in November on a line from the M., K. & T., near Bartlesville, Okla., west via Pawhuska to Enid, about 125 miles. Surveys now being made. The headquarters of the company are at Pawhuska. R. H. Hoss, president, Fairfax; C. Walters, vice-president and general manager, and E. J. Noonan, locating engineer, both of Muskogee. (Oct. 8, p. 662.)

PENNSYLVANIA.—An officer writes that the work of elevating the tracks in Philadelphia, Pa., on Trenton avenue, is progressing rapidly. The steel structural work for the removal of present grade crossings has been finished between Butler and Huntingdon streets, and it is expected that the steel work between the latter and Norris streets will be finished this year. The estimated cost of these improvements is $2,000,000, of which the city will pay $900,000. (March 19, p. 667.)

QUANAH, ACME & PACIFIC.—According to press reports this road has finished 26 miles of the line under construction from Quanah, Tex., south to Paducah, 38 miles. The line is to be extended eventually beyond Paducah in the direction of Roswell, N. Mex., and is to have a total length of 350 miles. (Sept. 17, p. 521.)

QUITMAN & GREAT NORTHERN.—See St. Louis, Texas & Gulf.

ST. LOUIS & OKLAHOMA.—Incorporated in Oklahoma with $50,000 capital and headquarters at Bromide, in Coal county. The plans call for a line from Sallisaw, Okla., west to a point between the Red river and the Salt Fork of the Red river in Greer county, about 300 miles. The incorporators include: O. E. Snyder, Erie, Kan.; J. D. Cameron, Kansas City, Mo.; E. S. Brodie, St. Louis; J. M. Sholl, Joplin; E. T. Brown, Colgate, and E. W. H. Jackson, of Bromide.

ST. LOUIS-KANSAS CITY ELECTRIC.—Incorporated in Missouri, with $5,000,000 capital, to build from St. Louis, Mo., west across the state of Missouri to Kansas City, about 295 miles, with a branch from Glasgow north to Brookfield. The incorporators include: D. C. Nevins, H. W. Johnson and B. L. Dorsey, of Denver; J. H. Reeder and H. E. Insley, Kansas City; W. A. Hamilton, of Chicago; S. P. Spencer, St. Louis; W. B. Cawthorn, Columbia, Mo., and R. B. Young, Kansas City.

ST. LOUIS, TEXAS & GULF.—This company has taken over the property and rights of the Quitman & Great Northern. The plans provide for building from Mineola, Tex., north through Quitman to Paris, 85 miles. The line is to be extended eventually south of Mineola to Port Arthur on the gulf. M. J. Healy, of Quitman, is president of the new company. (See Quitman & Great Northern, March 19, p. 657.)

SALEM, FALLS CITY & WESTERN.—According to press reports this company has finished the line from Dallas, Ore., east to Salem, 14 miles. L. Gerlinger, president, Portland, Ore. (March 19, p. 657.)

SOUTH ATLANTIC TRANSCONTINENTAL.—According to press reports the counties east and west of Charlotte, N. C., have voted bonds for building a line from the mouth of the Cape Fear river at Southport, N. C., west along the southern border of North Carolina, to connect the coal fields in Tennessee with the seaboard.

SPOKANE, PORTLAND & SEATTLE.—According to press reports from Aberdeen, Wash., this company has secured a right-of-way from Vancouver, Wash., on the Columbia river north through South Bend, the Willapa harbor country and the North River district to Cosmopolis, and it is said construction work will be started next spring.

TEXAS CENTRAL.—According to press reports this entire line is being ballasted and 80-lb. rails are being laid between Walnut Springs, Tex., and Hico. The question of building an extension from the present terminus at Rotan, in Fisher county, is also said to be under consideration. (July 2, p. 35.)

TEXAS ROADS.—According to press reports residents of Bryan, Tex., are back of a project to build from a point on the International & Great Northern at Fountain, six miles west of Bryan, southeast, crossing the Brazos valley at Pittbridge and down the Brazos bottom through the valley land included in the Levee district, which is to be protected from overflow. H. O. Boatright, G. S. Parker, R. S. Webb, E. H. Astin and W. E. Saunders, of Bryan, are said to be interested.

UNION PACIFIC.—The Pleasant Valley branch has been finished and is now in operation from Greeley, Colo., north to a point opposite Pierce, 13.16 miles. Side tracks are being laid to the new town of Campfield. (May 14, p. 1052.)

According to press reports track-laying was started November 1 on the Des Chutes Railroad, building from a connection with the Oregon Railroad & Navigation Co., at the mouth of the Des Chutes river, in Sherman county, Ore., south to Redmond, in Crook county, 130 miles. Subcontractors are at work from the mouth of the river south to a point seven miles south of Madras. (Sept. 24, p. 562.)

According to press reports plans have been filed in Colorado to build a cut-off from Dodd, southwest to Denver. It is said the new route will shorten the distance between Omaha, Neb., and Denver, 36 miles.

See Chicago, Milwaukee & Puget Sound. (Oct. 29, p. 829.)

VIRGINIAN.—An officer writes regarding extensions to be built up Flipping creek and Crane creek, in West Virginia, that construction work has not been started and contracts have not been let.

WACO, BELTON & GEORGETOWN.—Incorporated in Texas to build from Waco, Tex., south to Georgetown, where connection will be made with the Missouri, Kansas & Texas and the International & Great Northern, about 80 miles. The general offices of the company are at Waco. E. Rotan, W. D. Lacey, Dr. S. P. Brooks, J. C. Dillard and W. W. Seley, all of Waco, are said to be interested.

Railroad Financial News.

Chicago, Cincinnati & Louisville.—Newman Erb and associates have bought, it is said, at 50, $2,600,000 of the outstanding $3,016,000 general and refunding mortgage 4½ per cent. bonds, in addition to $374,000 notes bought recently.

Chicago Terminal Transfer.—Counsel for the Baltimore & Ohio have discontinued the suit brought by this road to have the Chicago Terminal Transfer sold under foreclosure subject to the lease held by the Baltimore & Ohio. The federal court at Chicago, in which the case was pending, has ordered a special master to set an early date for the sale of the property, at which time there seems no doubt that it will come under the complete control of the Baltimore & Ohio.

Houston & Texas Central.—See an item in regard to this company under State Commissions.

Indiana Southern.—Judge Kohlsaat in the United States Circuit Court has ordered Receiver Carpenter, of the Indiana Southern, to pay the principal on $40,000 of the company's car trust notes due Nov. 1, and $11,428 interest on $457,162, the aggregate amount outstanding in promissory notes.

Lehigh Coal & Navigation Co.—Besides the regular semi-annual dividend of 4 per cent. an extra dividend of 1 per cent. has been declared, payable November 27. The company has paid 8 per cent. annually since 1904.

New York, New Haven & Hartford.—In connection with the increase from $40,000,000 to $50,000,000 in the amount of additional stock to be issued, President Mellen says that this additional amount is required by the fact that $21,878,100 stock of the New Haven company, held in the treasury of the New England Navigation Company, carries the right to subscribe for new stock. On June 30, 1909, this New Haven stock was held in its own treasury and was additional to the $100,000,000 shown as outstanding. Security holders have the privilege of subscribing to new stock at 125, as follows: Stockholders to 25 per cent. of their holdings, 3½ per cent. convertible debenture holders to 16⅔ per cent. of their holdings, 6 per cent. convertible debenture holders to 25 per cent. of their holdings.

Pennsylvania.—Directors have voted to issue additional stock to the extent of 25 per cent. of the stock outstanding November 15. At present there is outstanding about $316,000,000 stock, so that on the present basis the new stock issue would amount to approximately $80,000,000. In addition to the stock outstanding at present there is an aggregate of $117,440,000 convertible bonds. If all the bonds were convertible before November 15 the stock issue would be about $100,000,000. Of the bonds, $18,840,000 are convertible at 140 and $98,592,000 are convertible at 150. The subscription rights were dealt in on the New York curb market, selling between 9 and 7.

San Pedro, Los Angeles & Salt Lake.—Stockholders are to vote December 21 on the question of authorizing the directors to retire the authorized $50,000,000 (of which $40,000,000 are outstanding) first mortgage bonds, dated July 1, 1903. Stockholders are also to vote on authorizing $60,000,000 mortgage bonds, to be dated July 1, 1909. The *Commercial & Financial Chronicle* says that of the existing $40,000,000 bonds nearly all are owned by Senator Clark and his friends and by the Union Pacific, and even if no right to call exists, it will no doubt be an easy matter to refund the bulk of the old bonds.

Washington, Baltimore & Annapolis.—On October 28 President George T. Bishop and George W. Williams were appointed receivers. The coupons due May 1, 1909, on the first and second mortgage bonds, remain unpaid.

Western Pacific.—On October 26 James C. Jeffery, C. H. Schlacks and Charles M. Levey were elected directors, succeeding S. C. Mathews, H. M. McCartney and William A. McGee.

Late News.

The Norfolk & Southern's inquiry for cars, noted in another column, has been increased to 200 flat and 300 box cars.

C. S. Calvert has been appointed a commissioner of the Transcontinental Railway, with office at Ottawa, Ont., succeeding R. Reid, deceased.

The extension of the Carolina, Clinchfield & Ohio from Bostick, N. C., south to Spartanburg, S. C., 31.1 miles, was formally opened on October 29. (Oct. 29, p. 827).

Contract is said to be let to the Ferguson Construction Co. and to Henry Steers for building the New York, Westchester & Boston from Mount Vernon, N. Y., to White Plains, about nine miles.

The state of Durango, Mex., has granted a concession to Harris Walthal, representing British capitalists, to build a line, to develop a mining section, from Durango northwest to San Dimas, near the Sinaloa boundary.

An officer of the Lake Shore & Michigan Southern is quoted as saying that a large amount of money is to be spent next year building about 175 miles of new third, and fourth track, and laying about 35,000 tons of rails.

Spokane press rumors say that the Northwestern Improvement Company has bought 60 per cent. of the common stock of the Spokane & Inland Empire. The Improvement Company is a subsidiary of the Northern Pacific.

The newspapers say the Pennsylvania has decided to build a new passenger station in Baltimore, Md., to cost $1,500,000, on the site of the present terminal. It is to be built chiefly by the Northern Central and will be used also by the Pennsylvania.

Press despatches say that the union clerks in the freight and yard departments of the New Haven have voted to strike for higher pay, minimum wage rate and overtime pay. A meeting was to have been held yesterday to decide when the strike would be called.

Under the name of the South Atlantic Transcontinental a line is to be built from Knoxville, Tenn., east to Southport, N. C., at the Atlantic seaboard. Contract has been let to the McArthur Brothers Co. The work will include six bridges and two tunnels. S. A. James is president and W. F. Robinson, chief engineer.

Reuben A. Henry, formerly general ticket and passenger agent of the Delaware, Lackawanna & Western and later general auditor of the Delaware & Hudson, died November 3 at his home in Jersey City, N. J., at the age of 91. Mr. Henry retired from business about 17 years ago and was a son of William Henry, the founder of Scranton, Pa.

The New York Central and Hudson River has applied to the New York Public Service Commission, Second District, for authority to issue $44,658,000 additional stock at not less than par. Part of the proceeds from the sale of the new stock will be used to retire $25,000,000 of 5 per cent. notes maturing February 1, and the remainder will be spent on various improvement projects. The company now has outstanding $178,632,000 stock. The company has $71,368,000 stock in its treasury unissued.

The expenditures of the New York Central for construction and improvements subsequent to September 1, 1909, includes $13,920,400, to be used in connection with the electrification of the lines and station improvements in New York City and vicinity, making the total amount for these improvements $29,165,100. President Brown is quoted as follows: $6,000,000 is to be used for work upon the Grand Central station and terminal, and about $8,000,000 for equipment, including signaling apparatus, betterments in yards, grade revision and curve elimination. All the money is to be spent on the New York Central & Hudson River Railroad, the lines east of Buffalo. Some of the money will be used for electrification as far north as North White Plains; for four-tracking and electrification between Highbridge and Croton; four-tracking on the Hudson division between New York and Albany; second-tracking the Rome, Watertown & Ogdensburg, and second-tracking the Pennsylvania division. About $1,000,000 is also to be spent for improvements in shop and engine terminals.

Supply Trade Section.

The United States Brake Shoe Co., Corry, Pa., has let the contract for a steel and concrete building 90 ft. x 200 ft. Machinery for the addition may be purchased later.

F. C. Close, formerly assistant purchasing agent of the Michigan Central, has been appointed secretary and treasurer of the Windsor Lumber Co., with office at New York.

The Hall Signal Co., New York, has put a night force to work, making a 24-hour operating day for the first time in several years. Orders are coming in steadily, and are booked for months ahead. In common with the other equipment companies the company is having some trouble in getting materials. Steel pipe is being delivered from six weeks to two months behind time.

An officer of the American Rolling Mill Co., Middletown, Ohio, writes that the company expects to build a new plant, probably in Middletown. The addition will include an open-hearth department, blooming mill, bar mill, jobbing mills, plate mill and additional sheet mills. The total cost of the improvements is estimated at $3,000,000. The company manufactures a new metal called American Ingot Iron, which is claimed to have special rust-resisting qualities.

One of Wm. H. Wood's patent corrugated firebox and tube plates, complete, can be seen and examined at the Baldwin Locomotive Works, Philadelphia, Pa. N. A. Gillis, formerly general superintendent of the Richmond Locomotive Works, for the American Locomotive Co., is now a partner in the firm of Fowler, Hardesty & Gillis, consulting engineers, Home Life building, Washington, D. C., who are the Southern representatives for the Wm. H. Wood Loco Firebox & Tube Plate Co., Media, Pa.

The Canada Car & Foundry Co., Montreal, Que., has been formed to take over the property of the Canada Car Co., Montreal (heretofore a subsidiary of the Pressed Steel Car Co., Pittsburgh, Pa.), the Dominion Car & Foundry Co., Montreal, and Rhodes, Curry & Co., Amherst, N. S. The new company will have $5,000,000 preferred stock, $3,000,000 common and $3,500,000 6 per cent. bonds. It is understood that about half the preferred stock is to be underwritten in London, and that no securities will be offered in Canada or the United States.

The American Valve & Meter Co., Cincinnati, Ohio, will erect immediately a $25,000 addition to its plant. The company has acquired a piece of land on Court street with which, when improved, it will have a building with frontage of 110 ft. and depth of 90 ft. The addition will be of reinforced concrete, three or more stories in height, and is expected to be completed and ready for occupancy early in the new year. There will be some new tools required and a modern gas engine equipment for power. The company makes railway supplies, including Poage automatic water columns, switch stands, water meters, etc.

The Garner Nut Lock Co., Houston, Tex., has been incorporated, with a capital stock of $50,000, to manufacture a nut lock invented by W. R. Garner. The officers of the company are: President, W. R. Garner; vice-president, J. R. Cheek; secretary and treasurer, W. L. Van Liew; general manager, J. H. Conlan; attorney, John Charles Harris. In addition to the officers named, the board of directors includes E. N. Mills, Ike Keller, C. H. Strong and George L. Noble. The first factory is to be located in Houston, Tex., and branch plants will be established in Chicago, Newark, N. J.; Denver, Colo., and St. Louis, Mo. The first factory will be completed November 15 and after that time the company will be ready to fill orders for nut locks in any of the types advertised. The prospectus that has been issued describes the nuts and includes a number of testimonials from satisfied users.

Shipments of rebuilt locomotives during September and October by the Southern Iron & Equipment Co., Atlanta, Ga., were as follows: Memphis, Paris & Gulf, 2 consolidation; Texas State Railroad, 1 mogul; Gillmore & Pittsburg, 2 consolidation and 1 ten-wheel; Apalachicola Northern, 1 ten-wheel; Tennessee Central, 1 six-wheel switch; Bonlee & Western, 1 eight-wheel; Natchez, Columbia & Mobile, 1 ten-wheel; Santee River Cypress Lumber Co., 1 ten-wheel; Richland Parish Lumber Co., 1 Forney; Enterprise Lumber Co., 1 Forney; Southern Iron & Steel Co., 1 six-wheel switch; Southport Lumber Co., 1 8-wheel; Middle Tennessee R.R., 1 Pittsburgh consolidation and 1 Baldwin 8-wheel; Fort Smith Lumber Co., 1 Shay; Sullivan-Sanford Lumber Co., 1 Heisler; Stimpson Land Co., 1 saddle tank; A. J. Twiggs & Son, 1 Forney; Glynn Lumber Company, 1 Forney; Mengel Box Company, 1 Forney. Shipments of passenger cars were as follows: Memphis, Paris & Gulf, 1 coach and 1 combination passenger and mail; Atlanta & St. Andrews Bay, 2 coaches; Apalachicola Northern, 1 combination baggage and mail car; Middle Tennessee, 1 coach and 1 baggage car.

TRADE PUBLICATIONS.

Safety Mail Crane.—Burton W. Mudge & Co., Chicago, recently incorporated to deal in railway supplies, has issued a folder describing a safety mail crane which holds the pouch well back from the cab until the engine has passed, and then by means of a trip on the front truck of the tender drops into the normal position in time to deliver the pouch to the mail car. The illustrations show the relative position of the safety and the usual crane, and the safety crane in its three positions.

RAILROAD STRUCTURES.

ABILENE, TEX.—The Abilene & Southern has finished the foundations for a new passenger station. A wooden freight house is also being built.

DALLAS, TEX.—The Texas Railway Commission held a hearing at Dallas on October 26 on the petition of the Dallas Chamber of Commerce for an order to compel the railways entering the city to build a union station. Rhodes S. Baker, attorney for the Chamber of Commerce, contended that the existing stations are inconvenient, remote from one another, inadequate, dangerously surrounded and difficult of access. He said that the sites of the present stations could be sold for $600,000 and that a suitable site for a new union station could be bought for $900,000. There are at present five stations. The Chicago, Rock Island & Gulf and the Gulf, Colorado & Santa Fe use one station. The Houston & Texas Central, the Texas & Pacific and the Texas & New Orleans use the so-called union station. The Missouri, Kansas & Texas has a separate station, as has also the St. Louis Southwestern, and the Texas & Pacific and the Trinity & Brazos Valley enter the Texas & Pacific's so-called down-town station. F. G. Pettibone, vice-president and general manager of the Gulf, Colorado & Santa Fe, said that the railways were working on the union depot proposition and the only question now is whether all of the roads will decide to enter the proposed station or only five or six.

DENVER, COLO.—The Denver City Tramway expects to build a foundry, forge shop, planing mill, wood working shop and machine shop. Work is to be begun during the winter.

DES CHUTES, ORE.—According to press reports the Oregon Trunk Line, now building from a point on the Columbia river near the mouth of the Des Chutes river, south into central Oregon, will build a bridge over the Columbia river at the northern terminus, to connect with the Spokane, Portland & Seattle.

DETROIT, MICH.—An officer writes confirming the reports that a site has been secured for a new terminal station south of Michigan avenue, between Fifteenth and Twentieth streets. The details of the building for the new union station, etc., are not sufficiently advanced to furnish definite information at the present time. Work is now under way excavating beneath the present tracks to put in substructure for train shed, etc., prior to the electrification of the line for the approach to the new Detroit river tunnel.

HUGO, CAL.—The St. Louis & San Francisco is building a passenger station, to cost about $65,000.

LINCOLN, NEB.—At a recent meeting a committee of railway men was appointed to work out details for securing a new union station at that place.

NATCHEZ, MISS.—Bids are being received by the Yazoo & Mississippi Valley for putting up a new passenger station, to cost about $30,000.

ODESSA, WASH.—The Great Northern is planning to build a brick passenger station to replace the one now in use.

OLYMPIA, WASH.—The Northern Pacific is preparing plans for a brick passenger station to cost about $25,000.

OMAHA, NEB.—Plans have been agreed upon for improving the union station at an estimated cost of $100,000. The waiting room, baggage room and cafe are to be enlarged to meet the present demands. The interested roads are the Union Pacific, the Chicago & North Western, the Chicago, Milwaukee & St. Paul, the Illinois Central, the Wabash, the Missouri Pacific, the Chicago, Rock Island & Pacific and the Chicago Great Western.

PONCA CITY, OKLA.—The Atchison, Topeka & Santa Fe expects to build a passenger station and has petitioned the city officials to close one street. This move is opposed, however, by some of the business men and a temporary injunction has been secured to restrain them from building the station.

PROVO, UTAH.—The San Pedro, Los Angeles & Salt Lake is to build a $15,000 freight house.

ST. LOUIS, MO.—An officer of the Missouri, Kansas & Texas writes that ground has been bought as a site for a freight terminal yard in North St. Louis, and work is now under way filling sand in the low land with material taken from the Mississippi river bed. A roundhouse and other improvements will be added. The company has also secured ground in the downtown section as a site for a freight house. Work on the latter will not be started until next spring.

According to press reports bids are wanted November 16 for the steel superstructure of a municipal bridge. A bill is said to have been passed recently by the assembly appropritaing $1,600,000 for the work. The Missouri Valley Bridge & Iron Co., of Leavenworth, Kan., is already at work on the piers.

SAN FRANCISCO, CAL.—Work has been begun by the Western Pacific on a ferry slip and docks for the operation of its trains by ferry from Oakland to San Francisco.

SEATTLE, WASH.—The time for the completion of the drawbridges over the west waterway has been extended to June 1, 1910. The Northern Pacific is to put up a steel bascule bridge and the city may build a similar structure.

SHERIDAN, WYO.—According to press reports a new passenger station is to be built by the Chicago, Burlington & Quincy next year at Sheridan, to cost $95,000. About $40,000 additional is to be spent for a new freight house and yards.

TACOMA, WASH.—The Chicago, Milwaukee & Puget Sound is said to be making plans for a concrete boiler house for its new shops. Permits have been granted for shop buildings and work is now under way. The total cost of the improvements will be about $85,000. (Oct. 22, p. 781.)

TEXAS CITY, TEX.—According to press reports the Galveston-Houston Interurban will put up a power plant, to cost between $750,000 and $800,000. About 15 acres of land is said to have been bought for a site.

TOPEKA, KAN.—In addition to the oil house and shop office building previously mentioned, the Atchison, Topeka & Santa Fe is to build a general office building and a water service building. The office building is to be 75 ft. x 150 ft. and six stories high, with foundations designed with the intention of ultimately raising it to 18 stories. The construction will be of steel and concrete and all precautions will be taken to make it fireproof. The cost is estimated at $300,000. The plans for the water service building are not yet completed, but its cost is estimated at $75,000. (Oct. 29, p. 832.)

WALLACE, IDAHO.—Contract is said to have been given by the Oregon Railroad & Navigation Co. to the Wallace Construction Co. for putting up a passenger station to cost $20,000.

WALNUT SPRINGS, TEX.—According to press reports the Texas Central will soon start work on the 10-stall roundhouse. (Aug. 13, p. 300.)

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Detroit, Toledo & Ironton will buy 20 locomotives.

The Mexican Railway, as mentioned in the *Railroad Age Gazette* of October 29, has ordered four simple, consolidation, 2-ft. 6-in.-gage locomotives from the Baldwin Locomotive Works. They will burn wood.

General Dimensions.

Weight on drivers	74,400 lbs.
Total weight	83,000 lbs.
Cylinders	15 in. x 20 in.
Diameter of drivers	36 "
Boiler, type	Straight top
Working steam pressure	160 lbs.
Heating surface, tubes	1,072.0 sq. ft.
" " firebox	73.5 "
" " total	1,145.5 "
Tubes, number	126
" outside diameter	2¼ in.
" length	14 ft. 7 "
Firebox, type	Narrow
" length	47¾ in.
" width	42 "
" material	Carbon steel
Grate area	13 sq. ft.
Tank capacity for water	2,500 gals.

Special Equipment.

Axles	Hammered steel
Bell ringer	None
Boiler lagging	None
Brakes	Westinghouse
Brake-beams	Acme
Brake-Shoes	Cast iron
Brick arch	No
Couplers	Tower
Driving boxes	Cast steel
Headlight	Pyle-National
Injector	Nathan Monitor
Journal bearings	Bronze
Piston and valve-rod packings	Jerome metallic
Safety valve	Ashton
Sanding devices	Leach
Sight-feed lubricators	Detroit
Springs	Pittsburgh Spring & Steel Co.
Staying	Falls solid stay bolt
Steam gages	Crosby
Steam heat equipment	None
Superheater	None
Tires	Midvale steel
Tubes	Vochumer Verein
Valve gear	Baker-Pilliod
Wheel centers	Cast steel

The Norfolk & Western has ordered five Mallet compounds (2-8-8-2) from the Baldwin Locomotive Works, and five Mallet compounds (0-8-8-0) from the American Locomotive Co., as mentioned in the *Railroad Age Gazette* of October 22.

General Dimensions.

Type	2-8-8-2.	0-8-8-0.
Weight on drivers	360,000 lbs.	360,000 lbs.
Total weight	390,000 lbs.	360,000 lbs
Cylinders	24½ & 39 in. x 30 in.	24½ & 39 in. x 30 in.
Diameter of drivers	56 in.	56 in.
Type of boiler	Radial stay.	Radial stay.
Working steam pressure	200 lbs.	200 lbs.
Heating surface:		
Feed-water heater	1,369 sq. ft.	..... sq. ft.
Tubes	4,312 "	4,705 "
Firebox	213 "	200 "
Total	5.894 "	4,905 "
Tubes, number	350*, & 450†	334
" outside diameter	2¼ in.	2¼ in.
" length	21 ft.* 5¼ ft.†	24 ft.
Firebox, type	Semi-wide.	Semi-wide.
" length	120 in.	120 in.
" width	90¼ in.	90¼ in.
Grate area	75 sq. ft.	75 sq. ft.
Tank capacity for water	9,000 gals.	9,000 gals.
Coal capacity	14 tons.	14 tons.

*For boiler; † for feed-water heater.

Special Equipment.

Axles	Steel
Boiler lagging	Magnesia sectional, K. & M.
Brakes	Westinghouse-American
Brake-shoes	Perfecto
Brick arch	None
Couplers	M. C. B.
Driving boxes	Cast steel
Headlight	N. & W. standard
Injector	Monitor
Piston and valve-rod packing	U. S. Metallic
Safety valve	Ashton
Sanding devices	Leach
Sight-feed lubricators	Nathan
Springs	Union Spring Mfg. Co.
Staying	Tate flexible, in breaking zone
Tires	Latrobe
Tubes	Seamless steel
Valve gear	Walschaerts (2-8-8-2); Baker-Pilliod (0-8-8-0)
Wheel centers	Cast steel

The Cincinnati, Hamilton & Dayton is figuring on passenger and freight locomotives.

The Chicago & Alton is said to be figuring on 20 locomotives. This is not yet confirmed.

The Lehigh Valley has ordered four eight-wheel switch engines from the American Locomotive Co.

The Missouri & North Arkansas has ordered two Mikado locomotives from the Baldwin Locomotive Works.

The South Buffalo Railroad has ordered two six-wheel switch engines from the American Locomotive Co.

The Pennsylvania has ordered, for the Lines West, 25 simple consolidation (H-8) locomotives from the Baldwin Locomotive Works. The specifications include:

Total weight	238,100 lbs.
Weight on drivers	209,500 "
Cylinders	24 in. x 28 in.
Diameter of drivers	62 in.
Type	Belpaire, wide firebox
Working steam pressure	205 lbs.
Heating surface, tubes	3,652 sq. ft.
" " firebox	192 "
" " total	3,844 "
Tubes, number	465
" outside diameter	2 in.
" length	180 "
Firebox, inside	72 in. x 110¼ "
Grate area	55.13 sq. ft.
Journals, driving axle	9½ in. ; 10½ in. deep x 13 in. long
Journals, engine truck axle	5½ in. x 10 in.
Valve gear	Walschaerts

The Northern Pacific has ordered 31 Pacific and 11 Mallet articulated locomotives from the Baldwin Locomotive Works. The Pacifics were divided into two orders, 17 being reported August 20 and the additional 14 October 1. The Mallets were reported September 10, and are divided into two classes, five being of the 2-8-8-2 type and six of the 2-6-6-2 type. The Pacifics are to be delivered in November and the Mallets in December. The Pacific engines have the following general dimensions:

Weight on drivers	144,500 lbs.
Total weight	233,500 "
Diameter of cylinders	26 in.
Stroke of pistons	26 "
Diameter of drivers	69 "
Type of boiler	Wagon top
Working steam pressure	150 lbs.
Heating surface, tubes	2,218 sq. ft.
" " firebox	212 "
" " total	2,430 "
Tubes, number	195 2-in.; 22 5⅜-in.
" outside diameter	2 in. and 5⅜ "
" length	16 ft. 9 "
Firebox, type	Wide, with combustion chamber
" length	96 in.
" width	65¼ "
" material and maker	Steel; Lukens I. & S. Co. Worth Bros. Co.
Grate area	43.5 sq. ft.
Tank capacity for water	7,000 gals.
Coal capacity	12 tons

The five 2-8-8-2 Mallet engines have the following general dimensions:

Weight on drivers	294,150 lbs.
Total weight	425,900 "
Diameter of cylinders	26 in. and 40 in.
Stroke of pistons	30 "
Diameter of drivers	57 "
Type of boiler	Straight
Working steam pressure	200 lbs.
Heating surface, fire tubes	4,941 sq. ft.
" " feed water heater tubes	1,220 "
" " firebox	232 "
" " total	6,393 "
Tubes, number	401
" outside diameter	2¼ in.
" length	21 ft.
Firebox, type	Wide
" length	126 in.
" width	96 "
" material	Steel
Grate area	68.4 sq. ft.
Tank capacity for water	8,000 gals.
Coal capacity	12 tons

The six 2-6-6-2 Mallets have the following general dimensions:

Weight on drivers	256,200 lbs.
Total weight	300,300 "
Diameter of cylinders	20 in. and 31 in.
Stroke of pistons	30 "
Diameter of drivers	55 "
Type of boiler	Belpaire straight
Working steam pressure	210 lbs.
Heating surface, tubes	3,708 sq. ft.
" " firebox	198 "
" " total	3,906 "
Tubes, number	311
" outside diameter	2¼ in.
" length	21 ft.
Firebox, type	Wide, Belpaire
" length	116⅛ in.
" width	66¼ "
" material	Steel
Grate area	53.4 sq. ft.
Tank capacity for water	8,000 gals.
Coal capacity	13 tons.

The following special equipment for the Pacific engines applies to all except where noted:

Axles	Open-hearth steel
Bell ringer	Northern Pacific standard
Boiler lagging	Magnesia sectional
Brakes	Westinghouse-American
Brake-beams	American Steel Foundries
Brake-shoes	Christie; 5 Mallets, M. C. B. steel back
Brick arch	Garfield Fire Clay Co.; no brick arch on Mallets
Couplers	Sharon; Mallets, M. C. B.
Driving boxes	Cast steel
Headlights	Pyle-National Electrical Equipment; Mallets, Adams & Westlake
Injector	Hancock—type "A"; Mallets—2 Sellers—Class "K"
Journal bearings	Baldwin Locomotive Works: Mallets—Aurora "B" Metal
Piston and valve rod packings	Jerome: Mallets G. N. standard
Safety valve	3½ in. consolidated
Sanding devices	Leach
Sight-feed lubricators	Chicago—5-feed; Mallets—h. p., Michigan triple; l.p., Hart force, sight-feed oil pumps.
Springs	Furnished by R. R. Co.
Staying	Radial; 6 Mallets, Parallel
Steam gages	Ashcroft
Steam heat equipment	Gold (on Pacifics only)
Superheater	Schmidt (on Pacifics only)
Tires	Standard Steel Works Co.
Tubes	Iron—National Tube Co., Worth Bros. Co.
Valve gear	Walschaerts
Wheel centers	Cast steel

CAR BUILDING.

The Detroit, Toledo & Ironton will buy 2,500 freight cars.

The Atlantic Coast Line is in the market for 750 steel underframe box cars.

The Indian Refining Co., New York, is figuring on a number of tank cars.

The Norfolk & Southern is in the market for 100 thirty-ton flat and 200 forty-ton box cars.

The Wabash & Northern Indiana Traction Co. is in the market for nine interurban cars.

The Bloomington & Normal Railway & Light Co. has ordered three electric cars from the Danville Car Co.

The Northern Ohio Traction & Light Co. is said to be in the market for 15 cars. This is not yet confirmed.

The Toledo Railway & Light is said to have ordered 20 city cars from the Kuhlman Car Co. This is not yet confirmed.

The Northern Pacific has not ordered 1,500 refrigerator cars, as mentioned in the *Railroad Age Gazette* of October 22.

The Delaware, Lackawanna & Western is said to be in the market for 500 box cars and 500 gondolas. This is not yet confirmed.

The Southern Railway is said to have ordered 200 thirty-ton stock cars from the Lenoir Car Co. This item is not yet confirmed.

The Pennsylvania denies that it is in the market for 80 all-steel coaches, as reported in the *Railroad Age Gazette* of October 29.

The Chesapeake & Ohio denies the order for 300 cars from the Cambria Steel Co. mentioned in the *Railroad Age Gazette* of October 29.

The Rock Island-Southern, Monmouth, Ill., has ordered 75 forty-ton gondolas and 50 thirty-ton box cars from the Haskell & Barker Car Co.

The Central of Brazil is said to be contemplating the purchase of 100 closed motor cars for extra wide gage. This is not yet confirmed.

The Pennsylvania Steel Co. is said to have ordered 20 Summers ore cars from the Summers Steel Car Co., Pittsburgh. This is not yet confirmed.

The Atchison, Topeka & Santa Fe has increased the order for refrigerator cars mentioned in the *Railroad Age Gazette* of September 10 from 1,000 to 1,050.

The Berwind-White Coal Mining Co., Philadelphia, Pa., has ordered 300 coal cars from the Pressed Steel Car Co. This includes the 250 cars mentioned last week.

The Gulf, Texas & Western advises that all the equipment for which it was in the market has been ordered and received and that no further orders are contemplated.

The Southern Railway has ordered from the General Electric Co. two gas-electric motor cars. These cars will be equipped with two standard commutating pole railway motors of 100 h.p. on the forward truck. The current is supplied from a 600-volt generator, direct-coupled to an eight-cylinder gas-engine in the forward compartment. Combined straight and automatic air-brakes will be provided with the usual valves and accessories. The car bodies will be of steel, about 55 ft. long, with a seating capacity of 52 passengers. Both rear and center entrances are provided. The cars will be lighted by electricity. The order for these cars was placed after a thorough test of this type of car between Manassas and Strasburg last summer.

The Atlanta, Birmingham & Atlantic has ordered 25 stock cars from the American Car & Foundry Co., as mentioned in the *Railroad Age Gazette* of October 29. These cars will measure 40 ft. 2 in. long and 9 ft. 1½ in. wide, inside, and 41 ft. long and 9 ft. 5¾ in. wide, over all. Bodies and underframes will be of wood. The special equipment includes:

Bolsters, body	Simplex
Brakes	Westinghouse
Brake-beams	I-beam
Brake-shoes	Christie head
Brasses	Ajax
Couplers	Sharon
Draft gear	Farlow twin spring
Dust guards	Symington
Journal boxes	Symington Torsion
Roofs	Double board, prime pine
Side bearings	Miner
Springs	Railway Steel-Spring Co.
Trucks	Diamond rigid
Wheels	Cast iron

The New York, Ontario & Western, as reported in the *Railroad Age Gazette* of October 29, has ordered eight steel underframe passenger cars from the Harlan & Hollingsworth Corporation. These cars will carry 75 passengers and will measure 63 ft. 4 in. long and 9 ft. 3 in. wide, inside, and 72 ft. long, 10 ft. 5 in. wide and 15 ft. high, over all. The special equipment includes:

Axles	Carbon steel
Bolsters, body	Commonwealth Steel Co.'s double
Bolsters, truck	Steel
Brakes	Westinghouse
Brake-beams	Davis high-speed
Brake-shoes	American Brake-Shoe & Fry. Co.
Brasses	Brady Brass Co.
Couplers	Gould
Curtain fixtures	Curtain Supply Co.
Curtain material	Pantasote
Draft gear	Gould friction
Journal boxes	Gould
Lighting system	Safety Car Heating & Lighting Co.
Paint	Sherwin-Williams
Platforms	Gould
Roofs	Canvas and felt
Springs	Railway Steel-Spring Co.
Trucks	Commonwealth Steel Co.
Vestibule trap doors	Edwards
Vestibules	Pullman
Vestibule diaphragms	Ajax
Wheels	Midvale Steel Co.
Window fixtures	National

MACHINERY AND TOOLS.

The Blue Island Car & Equipment Co., Blue Island, Ill., is to install a heavy-duty Corliss engine in its power plant.

The Peoria Railway Terminal Co., Peoria, Ill., is in the market for two generators, two turbines and the necessary equipment.

The Isthmian Canal Commission asks bids up to November 12 on a pumping plant consisting of two 10-in. centrifugal pumps, direct-connected to 60-h.p. motors; one pipe-cutting and threading machine; seamless steel tubing; lumber, etc. (Circular No. 542.)

IRON AND STEEL.

The Boston & Maine is inquiring for about 500 tons of bridge steel.

The Great Northern is in the market for 10,000 to 40,000 tons of rails.

The Atlantic Coast Line has ordered 7,500 tons of rails from the Pennsylvania Steel Co.

The National of Mexico has ordered 7,500 tons of rails from the Pennsylvania Steel Co.

The Bessemer & Lake Erie has ordered 3,500 tons of rails from the Carnegie Steel Co.

The Texas-Mexican Ry. is said to have ordered 1,900 tons of rails from the Carnegie Steel Co.

The New York Central & Hudson River, it is said, will place bridge and other structural contracts soon.

The Chicago & North Western has ordered 1,600 tons of steel from the American Bridge Co. for work at Oxbow, Ore.

The Union Pacific has ordered from the American Bridge Co. 2,000 tons of steel for a bridge over the American river in California.

The New York Central & Hudson River has ordered the structural steel for its Buffalo freight house from the Buffalo Structural Steel Co.

The Southern Pacific has ordered 2,000 tons of structural steel from the American Bridge Co. for a bridge over the Sacramento river near Sacramento, Cal.

The Norfolk & Western is said to have ordered 1,400 tons of bridge steel from the American Bridge Co., 1,150 tons from the Virginia Bridge Co., and 625 tons from the Pennsylvania Steel Co.

The Buffalo, Rochester & Pittsburgh has ordered 9,000 tons of 90-lb., A. S. C. E. rails, for 1910 delivery, divided as follows: 3,500 tons Bessemer, 3,500 tons ferrotitanium Bessemer, and 2,000 tons open hearth.

General Conditions in Steel.—Most steel companies have had to refuse business calling for early delivery. Plate mills and other railway material mills are still unable to supply the demand. There has been some increase in the demand for malleable castings. Contracts for finished steel products placed in October were about 3,000,000 tons. Orders for 1,200,000 tons of pig iron were placed. Orders for fabricated structural steel were light, amounting to only about 75,000 tons. Rail contracts were about 500,000 tons, or 200,000 tons less than in September.

SIGNALING.

The Chicago & Alton will erect thirty-four more automatic block signals between Bloomington, Ill., and Nilwood. The old installations between Cayuga and Dwight, between Springfield and Godfrey, Godfrey and Roodhouse and Roodhouse and Bloomington will be replaced by new signals.

Rotary Snow Plow.

A new form of rotary snow-plow, the Ideal, is shown in the accompanying illustrations. It was developed from numerous experiments with large models extending over several years before the present form for the snow expellers was adopted. Trials with a fully equipped plow are reported to confirm the results obtained from models.

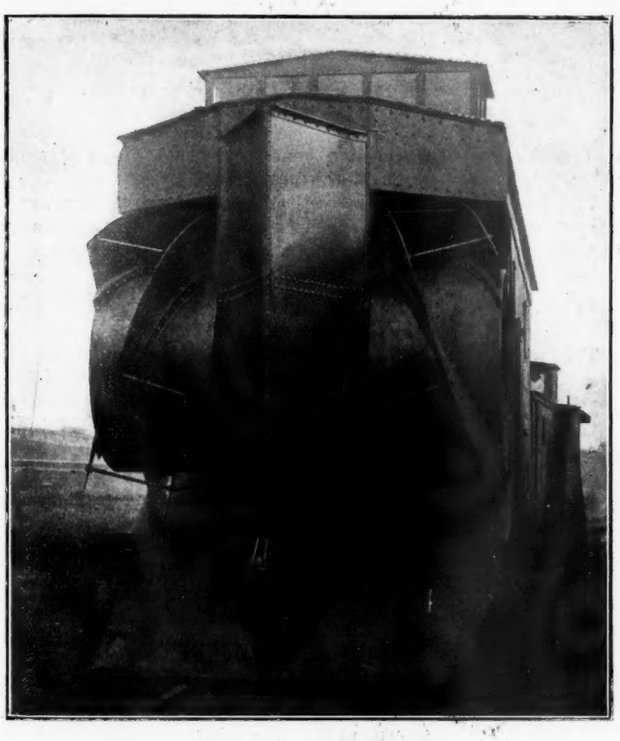
The plow body is all steel. The rear, or car part, is enclosed with wood, and the roof is wood covered with Ruberoid. There is a door on each side in the middle of the car, and the back end is left open for convenience in stoking. There is a cupola at the front end of the car from which signals can be given to the engineman.

The front end of the car, which is all steel, contains three chambers, the ones on each side, in which the expellers revolve, being semi-cylindrical and open at the front and one side. These chambers are 9 ft. in diameter and 3 ft. 6 in. wide. Each expeller consists of a cast iron hub, upon which are formed four spiral flanges having a pitch of about 14 ft. Riveted to these flanges are four ½-in. steel plates or blades 22 in. wide, which form a true helix upon the hub. These

expellers are mounted upon each end of an 8-in. shaft and overhang the pedestals. On the middle of the shaft is a large pinion which is connected to a similar pinion on the shaft of the engine by two Morse silent chains. The middle chamber is open to the interior of the car. Its front carries the nose of the plow, consisting of steel plates that project forward to the end of the apron or shovel. The latter is attached to the bottom framing, the side plates, the interior web plates and the expeller chambers by steel angles and plates, and the whole is covered by other steel plates. This apron extends forward 5 ft. beyond the center of the expellers. The nose and shovel are firmly riveted together to present a rigid construction to engage the snow.

The underframing of the car is composed of four steel channels with the necessary cross members riveted thereto. Means are also provided for the proper anchorage of the engines and boiler. The floor under and around the latter is of steel checkered plates, and under and around the engines it is white oak spiked to white oak longitudinal stringers bolted to the steel underframe.

The side framing of the car is composed of angles riveted to the side sills and top plates by junction plates, being similar



Front View of Plow.

in construction to a standard box car. The total length of the plow is 41 ft. 9 in., the extreme width at the expellers 11 ft., and the total height above the rail, 15 ft. The height inside is 9 ft. 9 in.; the width, 9 ft. 6 in., and the length, 30 ft. This space is occupied by the engines, boiler, pumps, etc.

The engines are made especially for this service, with massive beds and heavy working parts. The cylinders are 16 in. x 18 in. At 150 lbs. pressure, with a speed of 200 r.p.m., the engines develop 750 i.h.p. They are placed as near as possible to the expellers to give a short drive chain, and they exhaust into the bottom of the smokebox of the boiler through a nozzle, similar to locomotive practice, creating a strong blast.

The boiler is of the wagon-top locomotive type, fitted with Cyclone shaking grate, with means for expelling the ashes through the floor of the car. The ash-pit floor is covered with 3 in. of concrete. The boiler is fed by an injector, and there is an auxiliary duplex steam pump. All steam pipes and connections are of steel.

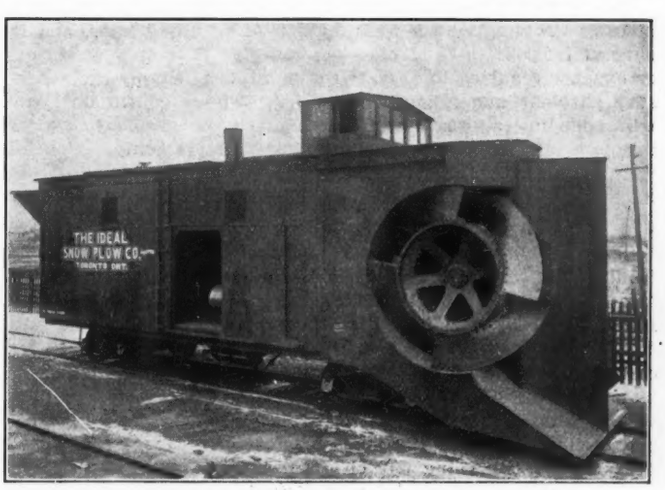
The plow is mounted on specially designed steel trucks with M. C. B. standard axles, those in the front truck having 5¾-in. x 10-in. journals, and in the hind truck, 4¼-in. x 8-in. journals. The approximate weight of the plow complete is 120,000 lbs.

When the plow is forced into a drift or cut the snow is lifted by the apron or shovel until it comes in contact with the expellers. The blades revolve at a high speed in an upward direction and throw the snow upwards and outwards at great velocity. The maximum velocity of the expeller blades at the periphery is 5,654 ft. per minute. The snow does not enter the expeller chambers. The two Morse silent chain belts are each 13 in. wide and are practically friction-

Twelve-Foot Cut Made by Plow.

less, having an efficiency of 96 per cent., it is claimed. Each of these belts is capable of driving the expellers at a moderate speed, so that if one should become disabled the plow would still be able to continue working, though more slowly.

The builders report that the plow was first tried on the Durham & Lucknow branch of the Canadian Pacific with good success, although the machinery had not been previously tried. Owing to the solid condition of the snow attacked, the plow could not penetrate the mass at a speed less than six to eight miles an hour, when the expellers rapidly threw out the snow. At eight miles an hour the plow would penetrate 45 to 50 ft. at a time, the expellers lifting tons of snow. The plow would then be withdrawn to take another run at the mass. By this method a large deep drift was cleared out in about two hours, the expellers throwing some portions to a distance of 50 to 60 ft. After getting through the heavy drift the plow cleaned up a stretch of snow varying in depth up to 5 ft. at a good steady run. Some of the snow banks removed had been accumulating for two months and had become so compact that blocks weighing 50 lbs. thrown out by the expellers could not be broken by an ordinary shovel. In fact, some portions were almost ice. The deepest drifts were



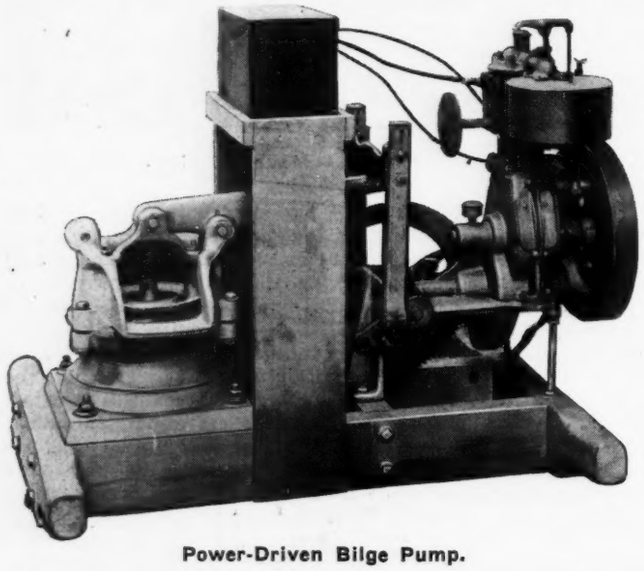
Side View of Plow.

from 10 to 15 ft. The company guarantees the plow to go through 10 ft. of hard snow at six to eight miles an hour. The plow body proved capable of withstanding the hard usage of such service. It has ample load on the front truck to keep it on the rails, but should the plow leave the track from any cause the front truck cannot slew around; the wheels will therefore run on the ties until the plow is stopped.

The inventor of the plow is E. Bowman, Elmwood, Ont. It is made and sold by the Ideal Cylinder Snow Plow Co., Ltd., 521 Dovercourt road, Toronto, Canada. A. G. McKay is president, and J. M. Wilson, vice-president, both with offices at Owen Sound; E. D. Weber, Toronto, is secretary-treasurer, and W. H. Law, Toronto, is consulting engineer.

Power-Driven Bilge Pump.

Fuller & Johnson, Madison, Wis., make a complete power-driven diaphragm bilge pump outfit for contractors, builders, railways, ship and barge owners or on public works where it is necessary to handle water containing mud, sand, grit, gravel, coal, grain or chips, sewage or any liquid that will flow. The engine and this type of pump are in general use separately, and are well known in their respective fields. The



Power-Driven Bilge Pump.

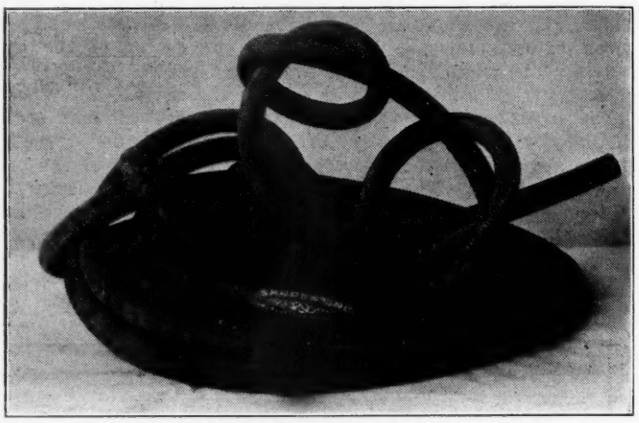
successful combination of the two, however, is a new feature. The pump outfit consists of one of the Fuller & Johnson farm pump engines, mounted on a substantial wooden base frame and connected by a special lever to one of the latest type of diaphragm pumps. The outfit is compact and portable and can readily be moved about as need requires.

The engine will exert a pull or lift of 1,000 lbs. on the lever at each stroke, giving a wide margin of surplus power, and it runs at from 31 to 35 strokes per minute. The only attention or expense required to operate the pump is to supply the necessary gasolene and lubricating oil. A 10-hour continuous run will consume approximately two quarts of gasolene, which means a total expenditure of not over 12 to 15 cents.

Serpentine Flexible Hose.

Serpentine flexible pneumatic tool hose is made by the Home Rubber Co., Trenton, N. J. It is intended primarily as a "lead" hose to deliver air to pneumatic tools. For this service hose should be tough and resilient. The rubber stock put into Serpentine gives it these qualities. Usually about 10 ft. of this hose is used next to the tool, to which it is connected by a coupling. The toughness is particularly needed to prevent the hose cracking or breaking at the coupling. The maker claims that this is a chief defect of ordinary tool hose, necessitating its being cut off from time to time and recovered, but that Serpentine does not so break at this point.

Its unusual flexibility is shown by the accompanying photograph. It can be tied in a knot without flattening and shutting off the air supply. This is due to the resiliency of the walls of the hose. This property has much to do with the ease of operation of pneumatic tools. The operator can climb around cars and under them without having to watch for kinks or otherwise pay much attention to seeing that the hose is properly placed behind him at every move. At the same time the walls of the hose are so flexible that in an



Serpentine Flexible Hose.

emergency the operator can bend it over on itself at such a sharp angle as to shut off the pressure.

The foregoing claims, as well as unusual durability, are the results of careful and severe tests on several railways, in locomotive works and in other shops using pneumatic tools.

Cast Steel Tie Plate.

The accompanying illustrations show a cast steel tie plate made by the Pittsburgh Track Specialty Co., a subsidiary of the Pittsburgh Equipment Co., Pittsburgh, Pa. As the illustrations show, it is an interlocking tie plate, one-half sliding under the base of the rail from either side and the two parts being locked firmly in place by the spikes. The spikes themselves do not touch the rail, the rail flange being firmly held by the two heavy lugs which take the place of the usual shoulders. The maker claims that this tie plate will hold rails at difficult places much better than any form of rail support or rail brace.

Cast Steel Tie Plate.

It has been in service on the main line of the Pittsburgh

Parts of Interlocking Tie Plate.

& Lake Erie, and orders were recently received from the Pennsylvania Railroad for 200 for trial.

Plate Glass.

Polished plate glass for passenger cars is superior in every respect to ordinary glass. It gives the coaches an elegant, finished appearance from the outside, and affords comfort to the passenger. When the lower cost of maintenance and renewal is also considered it is clear that the increased first cost is more than offset.